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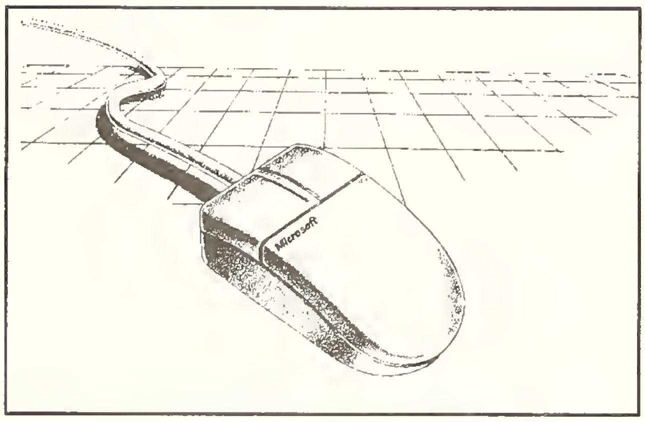
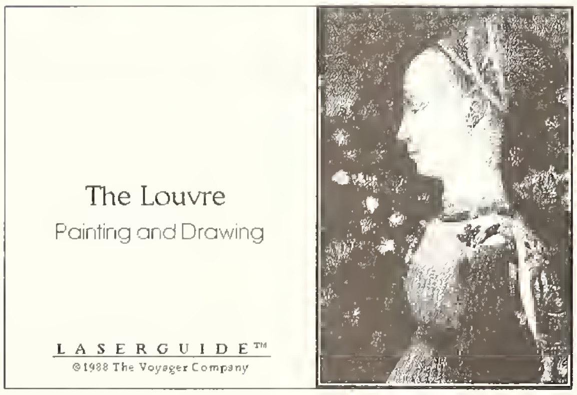
UTCS ComputerNews

1
What's NeXT



23
All About Mice

12
The Variable Face



The Louvre
Painting and Drawing

LASERGUIDE™
©1988 The Voyager Company

5
A Visit to MacWorld

ISSN 0315-4661 March 1989 No. 253

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This newsletter was entirely produced on a Macintosh using PageMaker and other related Macintosh software.

NeXT™

Dariusz Dabek
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Dariusz Dabek, one of the Information Centre Consultants, went to Santa Clara in January to receive training from NeXT, Inc., the company behind Steven Job's new NeXT computer. (Each university must have a NeXT-trained support person before they can purchase the NeXT computer.) The NeXT computer is now available on campus — it can be purchased through the Computer Shop and is on display in UTCS' Information Centre. If you wish to attend a demonstration of this machine, please contact the Education Coordinator at 978-4565 to reserve a place. If you want to explore the capabilities of the NeXT machine on your own, telephone 978-5601 to book a time.

What is the NeXT Computer?

The NeXT computer has been described as an "evolutionary, not revolutionary" machine. It is not a platform for great advances in computer technology; rather, it is an attempt to promote existing technologies within a demanding and specialized market — universities.

The Hardware

The computer itself (Motorola 68030 25MHz CPU, 128KB boot ROM, 8 to 16MB memory, 256KB video RAM) is housed in a 12 inch magnesium cube. Inside the cube, a mounting bracket can hold two 5.25 inch full-height storage devices. The preferred configuration is one erasable opto-magnetic drive (OD) and one magnetic Winchester-technology SCSI hard disk. (The single OD configuration without access to a network has no facility for backup.) The cube is attached to the 17 inch MegaPixel display by a 12 foot cable which, since the OD makes a disturbing noise when in use, can be used to position the cube some distance away. The OD is rated for 2 million read/write operations, which translates into about five years of constant use. Electricity for the machine is provided by a single power cable. The power key is located on the keyboard, as are the brightness and volume controls. The NeXT computer has an average failure cycle of 10,000 hours. Because of this, it is recommended that the machine be turned off when not in use. If left on continuously, it could fail after one year.

The Operating System

The underlying operating system of the NeXT is UNIX BSD 4.3 with MACH. UNIX provides the file system and the device drivers, while MACH supplies the virtual memory support, scheduling, and interprocess communications. The NeXT computer is configured so that a novice user does not need to know any of the UNIX administration skills

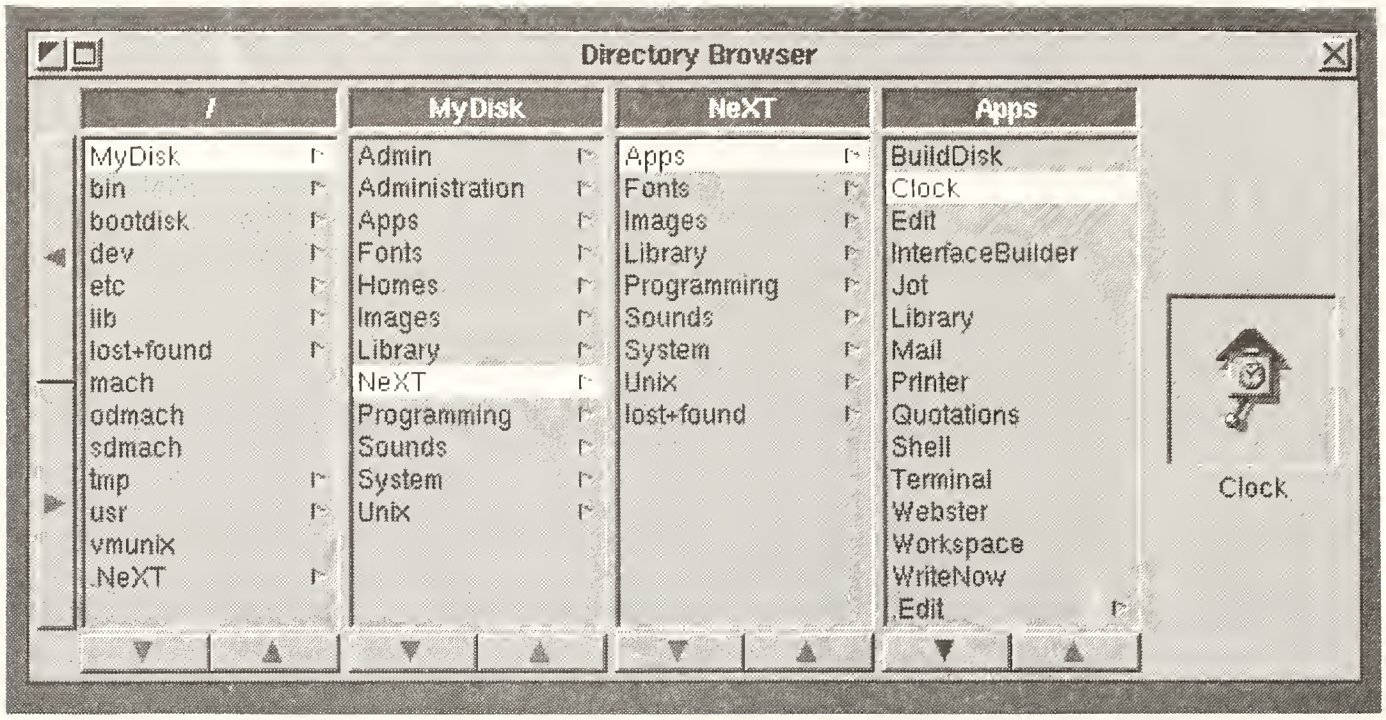


Figure 1

normally required to set up a system. A "me" account is provided and, when the machine is first turned on, it will automatically access this account. Even though UNIX is always present in the underlying layers, you need never see it to effectively use NeXT.

NeXT Step™: The User Interface

The user interface of the NeXT computer is called the NeXT Step. The Workspace™ and the Workspace Manager™, two main components of the NeXT Step, are comparable to the Macintosh Desktop and Finder. Since the underlying operating system is UNIX, the file system is that of UNIX. But NeXT has provided several ways to navigate the hard disk. The standard UNIX command-line interface and the Macintosh icon-based interface are both available. There is also the Browser™, an interface unique to NeXT. It includes tools to open, copy, link to, and manipulate files (see *Figure 1*).

When the machine is started, the Browser displays several columns containing directory entries of the current path. The user can quickly determine the location of a document by scanning adjacent columns. Directories are marked by an arrowhead symbol; unmarked entries are files.

The right side of the screen is reserved for the Application Dock. The Dock is a convenient place to store applications for word-processing, electronic mail, and so on. Applications in the Dock may be launched without first locating them in their home directories.

Applications and documents are launched by double-clicking. If a document is double-clicked, its parent application is launched and the document is loaded.

All applications provide mouse-accessible menus. They are "tear-off" rather than pull-down menus. A running application normally displays one columnar menu that can be positioned anywhere on the screen.

If you select an option on this menu, a new menu appears to the right of the original (see *Figure 2*). When a different option is selected on the original menu, the menu to the right changes. To preserve the menu on the right, it can be "torn off" and positioned elsewhere on screen. This stops it from disappearing when a new selection is made. In situations when several application are running, only the menus of the foreground application will be visible.

The visibility of the menus is one of the clues used to determine if an application is active or running. A running application is simply running, but an active application is running and able to accept input — that is, its menus are visible. To make an application active, you click one of its windows, just like on the Macintosh when running under Multifinder.

The Interface Builder

There has been a considerable amount written about the Interface

Builder™ (IB) for the NeXT computer. The sole purpose of the IB is to allow a simple and quick implementation of the user interface for all programs written on the NeXT computer. A very general analogy can be made between the IB and HyperCard.

HyperCard on the Macintosh is often used to provide a prototype user interface to an application. For example, we used HyperCard in our office to prototype a user-friendly front-end to UNIX electronic mail. Using HyperCard proved very effective, but we were not satisfied with it. We considered rewriting the entire project in a conventional programming language in order to create a completely functional application. Using IB on the NeXT system eliminates this final step of translating a prototype into a fully-functional user interface because it outputs Objective C code which can be linked very easily to the core application.

IB operates graphically on Application Development Kit™ (AppKit) objects, such as buttons, scroll bars and windows, and on any custom object created by the user. Once the objects are defined and arranged to form an application, the IB is used to define the relationships between them(*See Figure 3*).

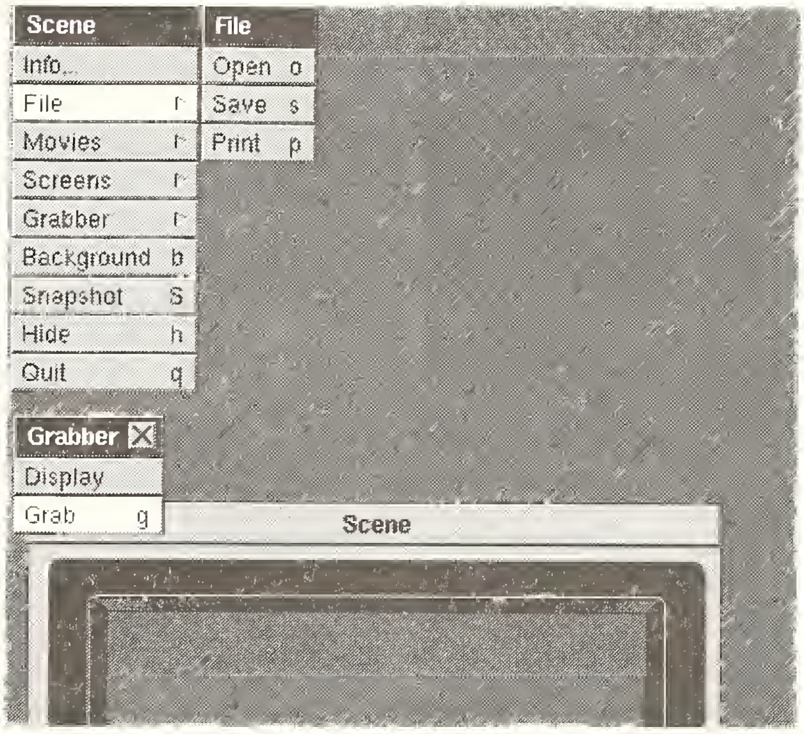


Figure 2

The State of the Software

NeXT is currently shipping the machine as version 0.8, which means that the system is still under development. In particular, none of

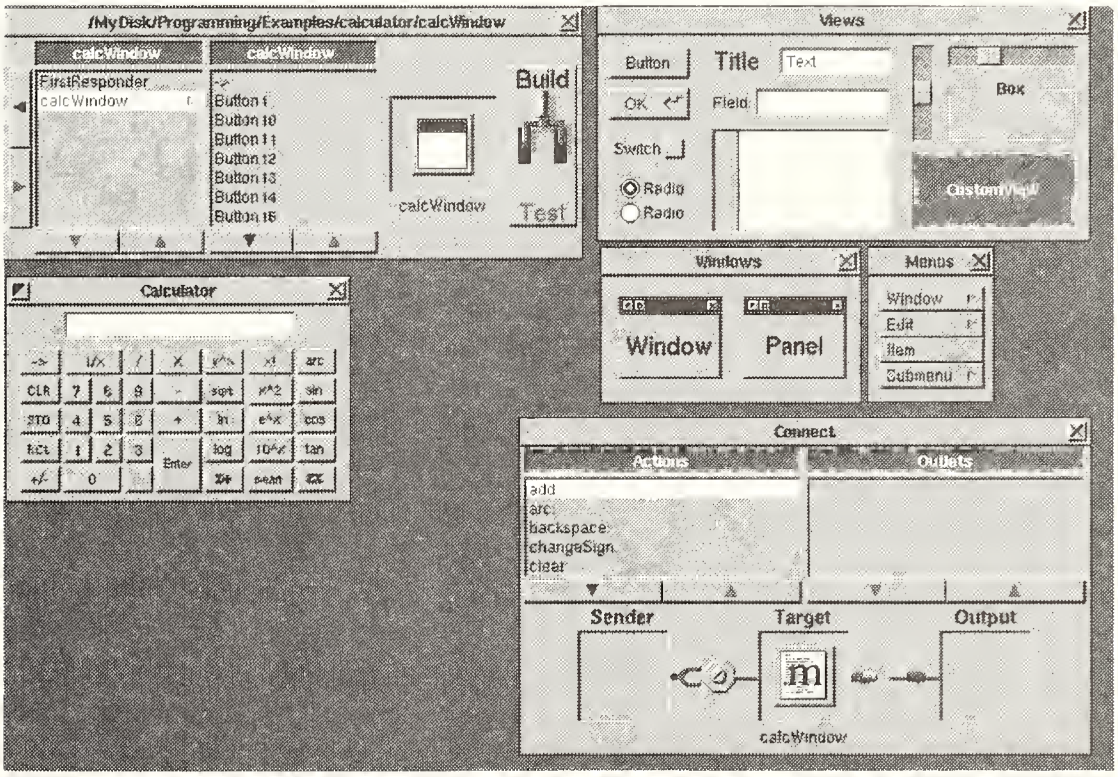


Figure 3

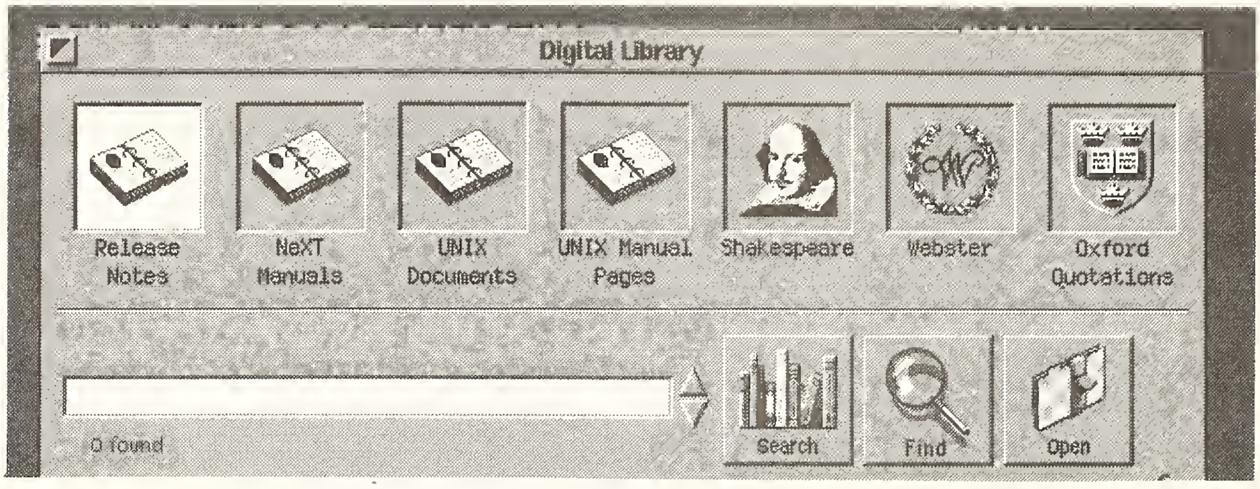


Figure 4

the third-party applications are available yet. The small number of applications that are available are not always stable.

The two main components of the development system — the AppKit and the IB — perform reliably. Printing is supported but is very erratic at this point. Sound and music development is possible using the Motorola 56000 DSP development kit. The software is available now directly from Motorola and will be included with version 1.0 of the NeXT.

All the software upgrades between version 0.8 and 1.0 are free and there will be no major hardware changes. Therefore, the instability of the present software should not negatively influence your decision to purchase a machine at this time. The timetable for software upgrades proposes that Version 0.9 will be available at the end of the first quarter of 1989 and that Version 1.0 will be available at the end of the third quarter.

Version 0.9 will include major upgrades to NeXT printing capabilities while, at the same time, instituting a freeze on further additions to basic features, which means that we will see a lot of new unstable options in anticipation of version 1.0. The end-user version, 1.0, should have all the bugs ironed out and should include the promised third-party applications.

Release 1.0 of NeXT will include:

System Software
- MACH OS
- Network File System
- System Administration tools

Application Development Tools
- Objective C 4.0
- GNU ANSI C Compiler
- GNU C debugger
- Standard Berkeley UNIX 4.3 BSD utilities
- Terminal emulator
- Window-based text editor
- GNU Emacs
- DSP Tools

NeXT Step

Window Server (including Display PostScript interpreter and fonts)
- Application Kit
- Interface Builder
- Workspace Manager

Additional Kits
- Sound Kit™
- Music Kit™

Applications

- Digital Library (*Figure 4* above)
  - Webster's Ninth New Collegiate Dictionary™
  - Webster's Collegiate Thesaurus™
  - Oxford™ Dictionary of Quotations
  - William Shakespeare: The Complete Works

- Electronic mail
- Jot - personal text database manager
- WriteNow™ - full feature word-processor
- Mathematica™
- NeXT SQL Data Base Server
- Allegro CL™ Common Lisp

NeXT documentation and other relevant technical documentation

Applications from the list above not included in Version 0.8 are:

- some portions of the System Administration tools
- the DSP Application Development tools
- Mathematica
- the NeXT SQL Data Base Server
- Allegro CL Common Lisp

MacWorld Products and Highlights

Dariusz Dabek
dabek@vm.utcs.utoronto.ca

At the MacWorld Exposition in January, about five thousand vendors presented products for the Apple Macintosh computer. The network, graphics, and database products described below were of particular interest.

Kinetics — LAN Ranger

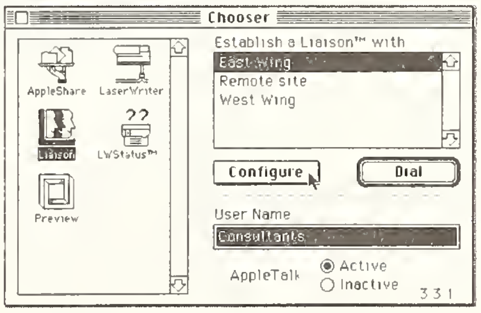
Kinetics introduced LAN Ranger, a diagnostic tool for AppleTalk network management. LAN Ranger is used for analyzing networks running multiple FastPath gateways. It provides the network administrator with a graphical view of the network and associated devices. Data on network topology, integrity, and activity can be collected by the program and used to more efficiently manage large networks. For example, this information can be used to determine if additional gateways are needed to eliminate excessive traffic throughout the network.

Infosphere — Liaison

Liaison is a software-only AppleTalk bridge. Developed by Infosphere, the creators of one of the first Mac local area network products, Liaison uses any Hayes-compatible modem to provide dial-up access to remote AppleTalk networks. It also allows LocalTalk-to-EtherTalk bridging if the machine running Liaison has an Ethernet card and is connected to an Ethernet network. Liaison was used at the show to bridge AppleTalk networks between two of the exposition sites, about five kilometers apart. For security conscious network administrators, Liaison provides password-protected access to various network/INTERNET services. The program is compatible with popular AppleTalk applications and runs in the background so there is no need to dedicate a Macintosh for the bridging tasks. Liaison offers one of the cheapest solutions for connecting a single remote Mac to a central network.

Farallon — Ethernet for Macintosh

Farallon (the original manufacturers of PhoneNet connectors) announced that it is planning to revolutionize Ethernet for the Macintosh in the same way it popularized AppleTalk over telephone wire. The plumbing for the network, which they will provide, will include EtherTalk connectors and Ethernet Star controllers, leaving the interface boards and software to other companies. The specifications of the network are in accordance with the IEEE 802.E 10-base-T standard. The Ethernet networks will be limited to 1000 feet with effective throughput of 2K- 2.5K, a significant improvement over LocalTalk. Users will also be able to mix both wiring schemes on the same network.

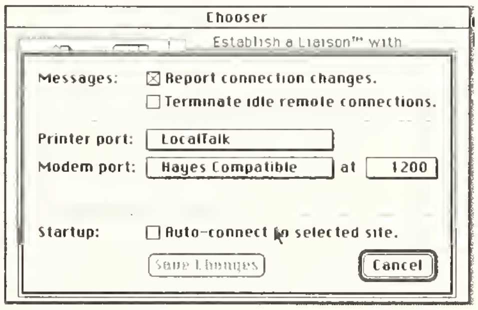


Establish a Liaison™ with
East Wing
Remote site
West Wing

User Name: Consultants

AppleTalk ● Active ○ Inactive

3.3.1



Establish a Liaison™ with

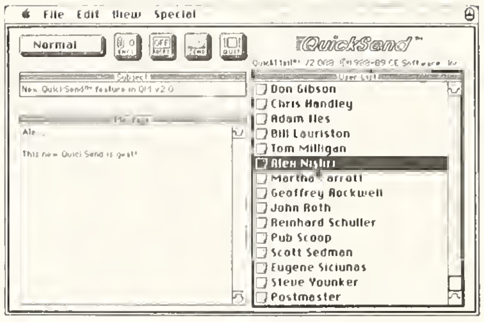
Messages: ☒ Report connection changes.
☐ Terminate idle remote connections.

Printer port: LocalTalk
Modem port: Hayes Compatible at 1200

Startup: ☐ Auto-connect to selected site.

CE Software — QuickMail

A major upgrade of QuickMail will be available at the end of the first quarter of 1989. Version 2.0 will significantly improve the speed of sending and receiving messages. The Quick Send feature will simplify sending quick, draft messages. Users who purchase QuickMail from UTCS will be able to upgrade to version 2.0 at a minimal cost. To find out more about QuickMail, read the the January/February issue of *ComputerNews*.



Subject: New QuickSend™ feature in QM v2.0

This new Quick Send is great!

- ☐ Don Gibson
- ☐ Chris Handley
- ☐ Adam Iles
- ☐ Bill Lauriston
- ☐ Tom Milligan
- ☑ Alex Nishri
- ☐ Martha arratt
- ☐ Geoffrey Rockwell
- ☐ John Roth
- ☐ Reinhard Schuller
- ☐ Pub Scoop
- ☐ Scott Sedman
- ☐ Eugene Siciunas
- ☐ Steve Younker
- ☐ Postmaster

Silicon Beach — SuperCard

Silicon Beach Software is the first company to introduce a HyperCard clone: SuperCard. SuperCard is more than a HyperCard clone, it is a major extension of Apple's product.

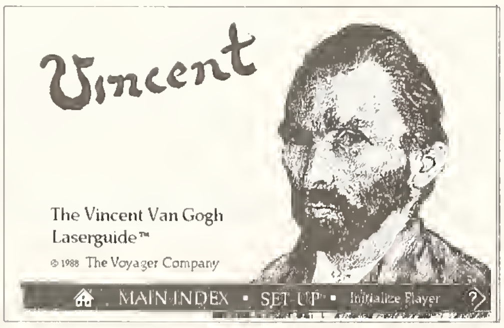
Significant features are:

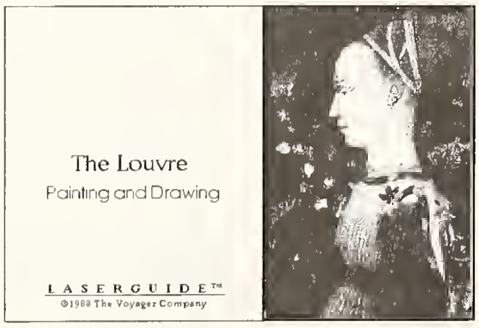
- enhanced scripting and editing features
- 256 colour Draw and Paint layers
- custom menus, palettes, and dialog boxes
- improved XCMD handling
- ability to create irregularly-shaped buttons
- stand-alone application generator

SuperCard should be available in the first quarter of 1989 at a suggested list price of US$199.00.

The Voyager Company — Laser Disks and HyperCard

One of the most interesting booths was that of The Voyager Company. Their work represents a fascinating combination of laser disk technology and HyperCard. A Mac running HyperCard provides user-friendly, intelligent access to large amounts of graphical information stored on laser disk. For example, the National Gallery of Art Laserguide, an award-winning software product, contains over 1,600 works from the National Gallery in Washington D.C. Another


Vincent
The Vincent Van Gogh Laserguide™
©1988 The Voyager Company
MAIN INDEX • SET UP • Initialize Player

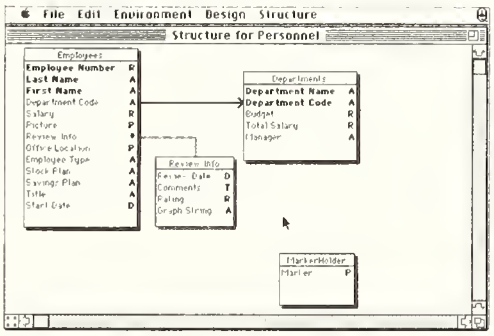


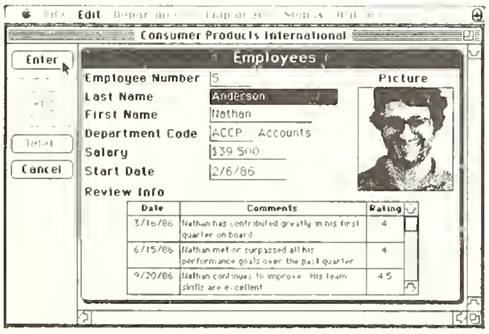
example is a stack and laser disk entitled *Van Gogh.* This package contains various stills and moving video images describing Van Gogh's life and work. Voyager's latest project is an interactive video of the Louvre Museum, designed specifically for children. They also offer a stack containing the commands necessary to control various laser disk players. You can use this stack to create your own applications.

Another interesting hardware and HyperCard combination was an AST board that played 16 frames/second video in a full-colour window on a HyperCard screen. All of the controls normally found on the laser disk were implemented as HyperCard buttons.

Acius — 4th Dimension

Acius has been showing off its flagship product, 4th Dimension(4D), for about a year and a half. The single biggest complaint about 4D has been its slow speed. The new version of 4D announced last summer in Boston, and shown again in San Francisco, has more speed and many new features. Scheduled for release in the first quarter of 1989, 4D will include a 200-400% improvement in speed, as well as support for CL/1, giving it access to SQL databases on any network.



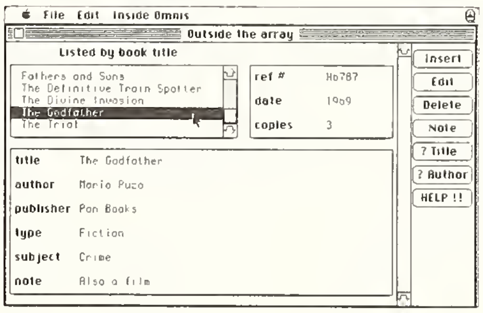


Employee Number 5
Last Name Anderson
First Name Nathan
Department Code ACCP Accounts
Salary $39 500
Start Date 2/6/86
Review Info

Date	Comments	Rating
3/16/86	Nathan has contributed greatly in his first quarter on board	4
6/15/86	Nathan met or surpassed all his performance goals over the past quarter	4
9/20/86	Nathan continues to improve. His team skills are excellent	4.5

Blyth — Omnis 3.3

Blyth has been curiously absent from recent MacWorld expositions. This time, however, it was showing the Omnis 3.3 database in conjunction with 3Com networks. Stressing the PC-to-Macintosh connectivity of Omnis, the Mac Omnis 3.3 and the PC Omnis Quartz were used to share data in real time on a network. (Supported networks are AppleShare, TOPS, Novell, and 3Com.) The new version of Mac Omnis has improved speed and the ability to write external commands. Omnis is due for a major revision this summer when a program, codenamed "Pebble," will be released. Pebble is rumoured to have features rivaling that of 4D, but with much greater speed.



Listed by book title

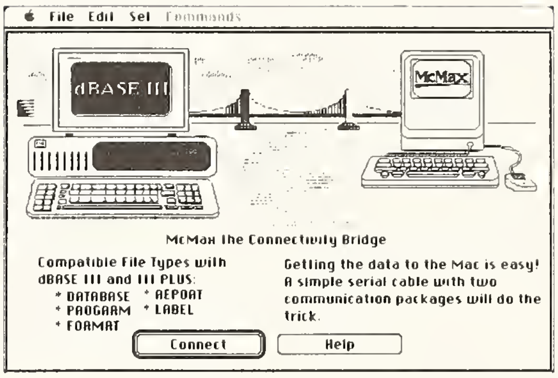
Fathers and Sons
The Definitive Train Spotter
The Divine Invasion
The Godfather
The Triot

ref # Ho787
date 1969
copies 3

title The Godfather
author Mario Puzo
publisher Pan Books
type Fiction
subject Crime
note Also a film

Nantucket – McMax

Nantucket, Inc., the maker of the popular dBASE III compiler, Clipper, was showing a new version of the Macintosh database program, McMax 2.0. McMax is fully compatible with dBASE III Plus on the PC, but features Macintosh extensions for improved use of the graphical user interface. The best news about McMax is its reduced price: $199.00.



McMax The Connectivity Bridge

Compatible File Types with
dBASE III and III PLUS:
* DATABASE * REPORT
* PROGRAM * LABEL
* FORMAT

Getting the data to the Mac is easy! A simple serial cable with two communication packages will do the trick.

Oracle – Oracle

Oracle for the Macintosh is a new product aimed at high-end micro database users. Oracle allows Mac users access to powerful database tools from within HyperCard and 4D. A set of external commands, with necessary SQL extensions, is provided for each program, so that programs on the Mac can access Oracle database servers residing on large networks.

For those interested in more information about products shown at MacWorld, please contact Dariusz Dabek by telephone at 978-8823 or through electronic mail at *dabek@gpu.utcs.utoronto.ca*.

Attention LISTSERV and Network Users: UTORONTO is changing to UTORVM

Steve Younker
postmstr@vm.utcs.utoronto.ca

On March 12, 1989, we will be changing the RSCS node name for UTCS' VM/CMS machine from UTORONTO to UTORVM. This change is being made in order to prevent confusion between our VM/CMS machine, which is currently called UTORONTO, and our network domain address, which contains UTORONTO as an integral part. This change will affect people using the CMS TELL and SENDFILE commands, as well as LISTSERV subscribers.

Currently, mail and messages are sent in many ways. The command

```
mail postmstr at vm.utcs.utoronto.ca
```

sends mail to the userid "postmstr" using the domain address "vm.utcs.utoronto.ca".

The command

```
mail postmstr at utoronto
```

sends mail to the same userid and location using the RSCS-style address "utoronto". The TELL command

```
tell postmstr at utoronto Hi Steve
```

uses the RSCS-style address as well, because TELL does not support domain-style addresses. This restriction also applies to the SENDFILE command.

How Does This Change Affect You?

On March 12, 1989, you will continue to tell people that your electronic mail address is:

userid@vm.utcs.utoronto.ca

and if they are unable to use a domain-style address (as in the TELL command) they should use

userid at utorvm

In general, the domain-style address will be used for electronic mail and the RSCS-style address for interactive messages or the SENDFILE command, if the recipient is on a CMS system.

Mail sent to the old address, UTORONTO, will continue to arrive at the correct destination for some time.

Changes for LISTSERV Users

This change will affect all people who subscribe to any private or closed LISTSERV list from the UTORONTO VM/CMS machine. After March 12, you will only be able to send submissions or commands to the LISTSERV list using the MAIL command. If you wish to continue using the CMS TELL command to communicate with LISTSERV, you will have to unsubscribe your UTORONTO electronic address from the affected lists and resubscribe to them using UTORVM.

To allow us to unsubscribe you from a list, please send mail to

postmstr@vm.utcs.utoronto.ca

giving the name(s) of the LISTSERV list(s) from which you wish to be deleted. We will then unsubscribe you from the list(s) named.

This exchanging of electronic addresses can only be done after the change from UTORONTO to UTORVM takes place and only UTCS can unsubscribe you from the affected lists. After the changeover, you can resubscribe at your leisure. There is no problem if you subscribe to a list with both the UTORONTO and UTORVM addresses. If you do, you will receive each mailing twice. To stop this, you will have to contact us as described above.

Since you will be dealing with private or closed lists, the list owners will probably wonder what is going on when you resubscribe. If they ask, tell them that your node name has changed and that you are in the process of updating your subscription.

If you have any questions about the address change on March 12 or the process of updating LISTSERV subscriptions, please contact Steve Younker at 978-6346. ▒

The Jean Talon Project: A Gift to the Twenty-First Century

Mark Vanderkam
pubscoop@vm.utcs.utoronto.ca

How would you like to own and use a personal computer containing huge amounts of visual, audible, and textual information on many aspects of Canadian society? Mr. Victor Glickman, the Director of Statistics Canada (Ontario Region), recently gave a talk at UTCS about a project that may put this type of resource within the reach of all Canadians.

In his present post, Glickman's primary responsibility is to collect and disseminate social and economic information. Every five years, he is given between $25 million and $30 million to run the census of Ontario. Always seeking better ways to distribute the census information, Glickman feels that an interactive computerized system may be the most efficient way to make large amounts of information widely available. He believes that microcomputer technology will, in the coming years, become more affordable and be able to handle much larger amounts of data than at present. This would give most people the ability to store and use large amounts of information, just as they now store and use music and video recordings.

Glickman explained that the BBC **Domesday Project** provided the inspiration to computerize Canadian information. As many of our readers know (*ComputerNews* reviewed Domesday in March 1988), Domesday is an interactive information delivery system developed to commemorate the 900th anniversary of the United Kingdom's first census. The BBC created an electronic portrait of life in the U.K. in the 1980s by bringing together vast quantities of video, photographic, textual, and other information into an easy-to-use computerized system.

Domesday uses a computer, two video discs, and a video disc player. The video discs store massive amounts of information, and the computer allows people to use the information on the discs. The system contains so much information that it would take a person seven years to read all that is contained on the two discs. It is so easy to use that each school board in the U.K. purchased one as a learning resource.

Citing the success of the Domesday Project, Glickman went on to explain that Canada can seize an opportunity to invest in a similar but more advanced project. He said it is possible to develop an open architecture information system that could be used by the public sector as well as a wide range of business, educational, and service interests. Glickman forsees the creation of a GISIS, a Geographic Image/Sound Information System. This would be a user-friendly system that would enable any interested person to use census and other information.

The First Step

On a federal level, officials are drafting a proposal for cabinet to give ten years of funding for the **Jean Talon Project**. The project is intended to be a national survey commemorating the 325th anniversary of the first Canadian census. (The first census was commissioned in 1966 by Jean Talon, Intendent of New France. Talon is considered the "father of modern census-taking" in Canada.) As Glickman informed us, all ten provinces are being consulted on what they want the content of Jean Talon to be.

Jean Talon would initially be designed for use in schools as an interactive video disc system. The developers hope that a large number of discs would be created by various interest groups. Discs on the environment, communities and cultures, museums and galleries, urban Canada, science, technology, trade, history, entertainment, and so on could be introduced, and together these would make a large historical information resource available for current and future use and study.

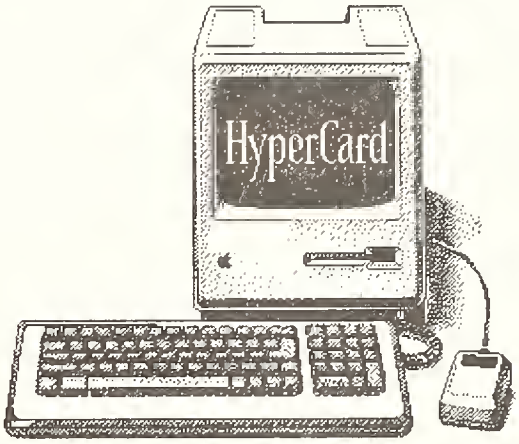
On a provincial level, organizations could create modules that would plug into the overall system. In Ontario, the plan calls for a module entitled **Who We Are**, a 1991 community census project that will consist of information selected to give a portrait of life in Ontario.

Preparing For Tomorrow's Technology

Glickman would like to encourage the development of a Canadian information industry. As explained in a paper distributed by Glickman, the people overseeing Jean Talon would publish all hardware and software specifications so that any interest group could create their own database. Glickman said that if and when the computer technology becomes affordable, people would purchase the system for business or personal use. This would stimulate the market for discs so that commercial interests would want to publish discs.

Of course, Glickman concluded, there are many unknown factors involved in a project such as this. No one knows where technology will go in the future. He does not want to create a system that will make itself dependant on old technology. He told us that when he talks about "open architecture," he is referring to a philosophical idea more than a technological system. He wants to see "Made in Canada" computerized information resources developed before the technology is upon us, so that we will have some Canadian content to place in the computer systems of the future. The Jean Talon Project, he hopes, will become an historical resource, offered as a "gift" to the people of Canada in the 21st century. ■

HyperCard Seminar



Many people have been asking about HyperCard – What is it? Should they be interested? For those who wish to learn this package, UTCS has developed an introductory seminar on HyperCard and its capabilities. The seminar will cover basics only, with participants learning to create and modify simple stacks. It is suitable as preparation for the more advanced HyperCard course offered by Apple's ARPP program here at U of T.

HyperCard Seminars scheduled to date are: **March 20, 1989**
10:00 a.m. – 12:00 noon

To register in the seminar, please call Irene Rosiecki at 978-4565. For more information about the seminar's content, please contact John Bradley at 978-3995.

SYGRAPH - SYSTAT's Graphics Bonus

Joyce Bernstein

The release of SYSTAT for the Macintosh environment has prompted statisticians and data analysts to take another look at the Mac world. For those who do look more closely, a full featured statistical package with a range of linear model and multivariate procedures comparable to the leading packages for DOS-based machines is not all that they will find; the graphical component of SYSTAT, a.k.a. SYGRAPH, is a most impressive bonus of this software.

The wide range of graphical displays included within SYGRAPH will likely be exciting to some and rather intimidating to others. Indeed, in his introductory remarks to the 900+ page graphics manual, co-author Leland Wilkinson cautions: "If all you want in a graphics package is to produce simple bar and pie charts . . . then this package is a lot more than you need. You can get other programs to do them." What you probably cannot get other packages to do for you are more elaborate bar and pie charts, scatterplots with a complete range of options and spline techniques, multiple box plots, icon plots (including multivariate graphic techniques such as Chernoff faces and Andrew's Fourier Plots, among others), stem and leaf diagrams, and probability plots for a variety of theoretical distributions. In addition, SYGRAPH can produce maps from files containing X,Y coordinates, which are processed using the IMPORT command in the SYSTAT DATA module. The graphs described above, by no means an exhaustive list, can be manipulated and enhanced using the many optional specifications. Several of these graphical options will be illustrated in this article.

Scatterplots

One of the most commonly used forms of graphic presentation is the 2-way scatterplot. A simple scatterplot is illustrated in *Figure 1A.* The code used to generate this example is:

```
USE CRIME
PLOT AUTOTHFT*ROBBERY
```

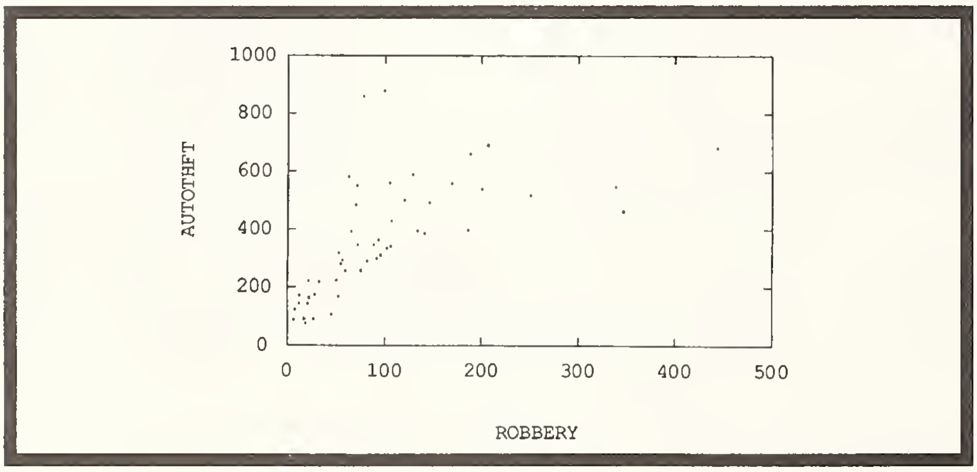


Figure 1A

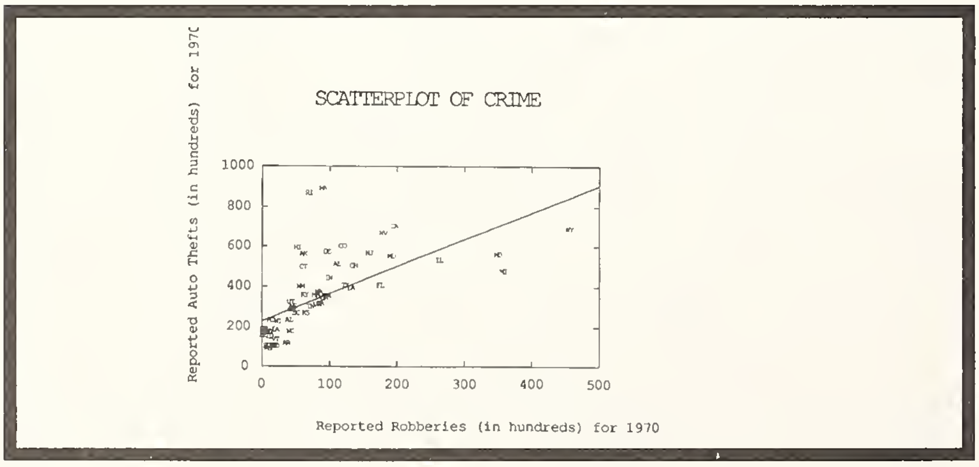


Figure 1B

CRIME is the name of an existing SYSTAT system file which includes the variables AUTOTHFT and ROBBERY, representing the numbers of reported crimes for each of the 50 states during 1970. In this example, we have allowed SYGRAPH to choose the axes scale and labels, as well as the plotting characters.

Figure 1B uses the identical data set, with the PLOT statement modified as follows:

```
PLOT AUTOTHFT*ROBBERY / LABEL=STATE$,
  SMOOTH=LINEAR,
  XLABEL='REPORTED ROBBERIES(IN HUNDREDS) FOR 1970',
  YLABEL='REPORTED AUTO THEFTS(IN HUNDREDS) FOR 1970',
  TITLE='SCATTERPLOT OF CRIME'
```

Here we have labelled individual points on the plot using the 'value' of the variable STATE$. As evidenced by the colliding labels in *Figure 1B*, this is one feature of SYGRAPH in need of some improvement. The best fitting regression line to the data is produced through use of the SMOOTH=LINEAR option; several other smoothing techniques are available, as are confidence intervals. *Figure 1C* also uses the CRIME data set. Here, the PLOT statement is preceded by the specifications

```
TYPE=BRITISH
THICK=2
```

These specifications adjust the font type and the thickness of the lines appearing on the graph. At the expense of some overkill, the GRID option has been added to the PLOT statement. To request both horizontal and vertical grid lines, GRID=3 must be specified. The revised PLOT statement follows:

```
PLOT AUTOTHFT*ROBBERY / LABEL=STATE$,
  SMOOTH=QUAD GRID=3,
  XLABEL= 'REPORTED ROBBERIES(IN HUNDREDS) FOR 1970',
  YLABEL= 'REPORTED ROBBERIES(IN HUNDREDS) FOR 1970',
  TITLE= 'SCATTERPLOT OF CRIME'
```

Here, quadratic smoothing has replaced linear.

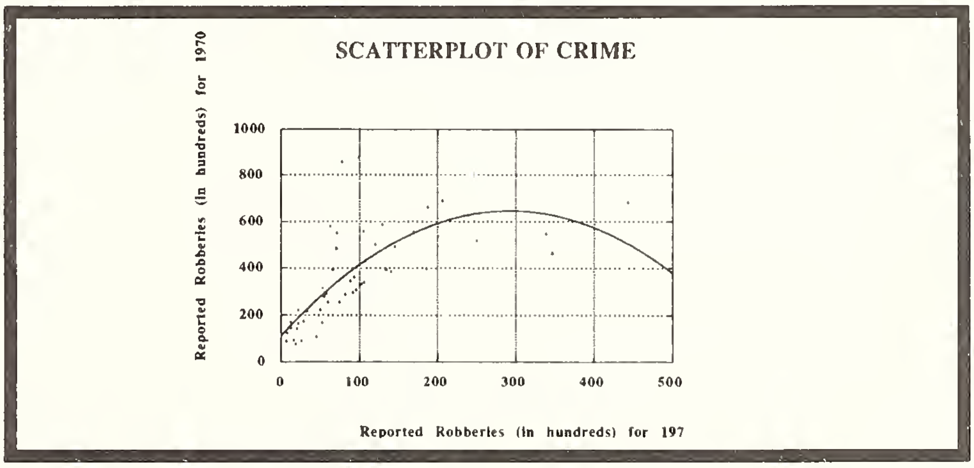


Figure 1C

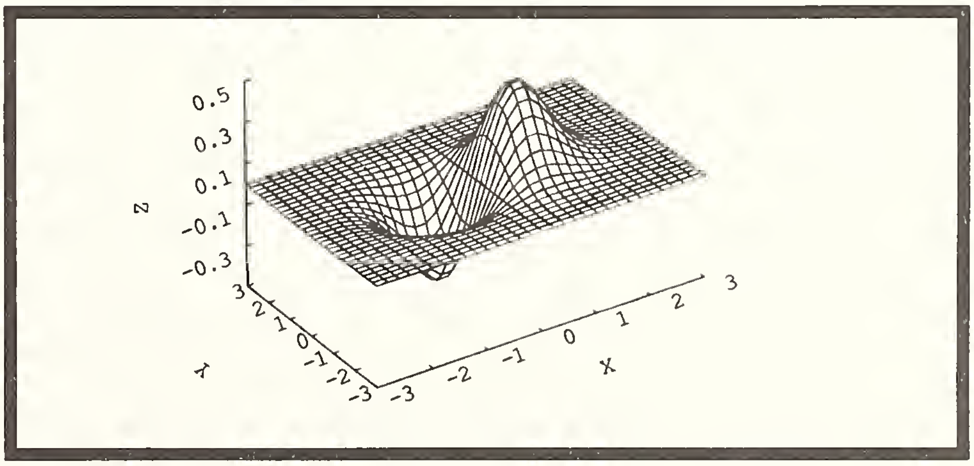


Figure 2

Three-Dimensional Plotting

Figure 2 illustrates SYGRAPH's three-dimensional plotting facility. The program which produced this graph is:

PLOT $Z=EXP(-X^2)*EXP(-Y^2)*X$,
! ZMIN=-.5, ZMAX=.5, HIDE, CUT=30

Note that the program did not use a previously created system file. The graph was generated from the equation appearing in the PLOT statement, providing a nice short-cut for the user accustomed to generating the data before plotting. In a case such as this, where the PLOT statement includes a mathematical expression, the exclamation point is used in place of the slash to mark the optional section of the statement. The options include the CUT= specification to control the appearance of the mesh-like surface as well as the HIDE option, to produce a cleaner picture. Because this latter option can significantly slow down the plotting process, it may be desirable to use this feature only for producing final graphs.

Bar Charts

As in the case of scatterplots, bar charts produced by SYGRAPH can be produced either very simply with little or no customization or they can be enhanced to publication quality. The simple histogram appearing in *Figure 3A* was produced with the following code:

```
USE US
BAR REGION$
```

The resulting histogram displays the number of data points in the system file "US" which fall within each of eight regions. Regional labels have been written diagonally to maximize space.

The two-way chart displayed in *Figure 3B* was produced with the code:

```
BAR SUMMER*REGION$ /YMIN=0
```

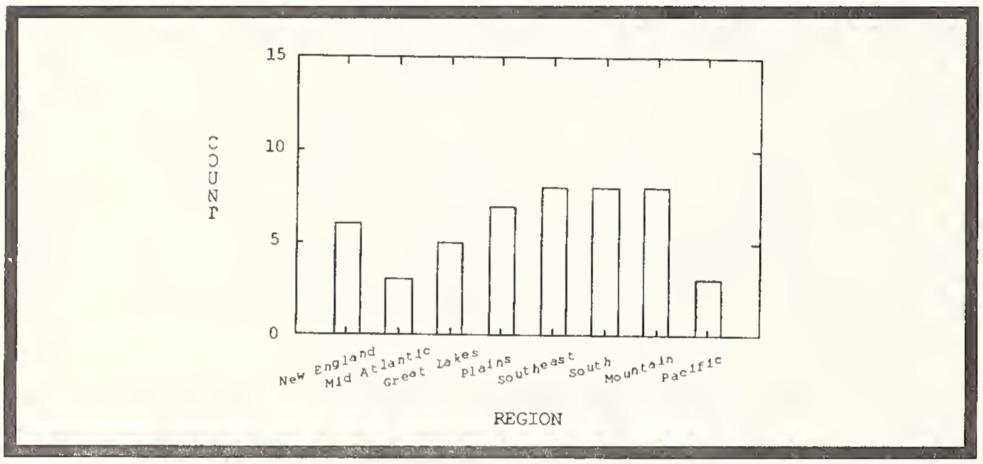


Figure 3A

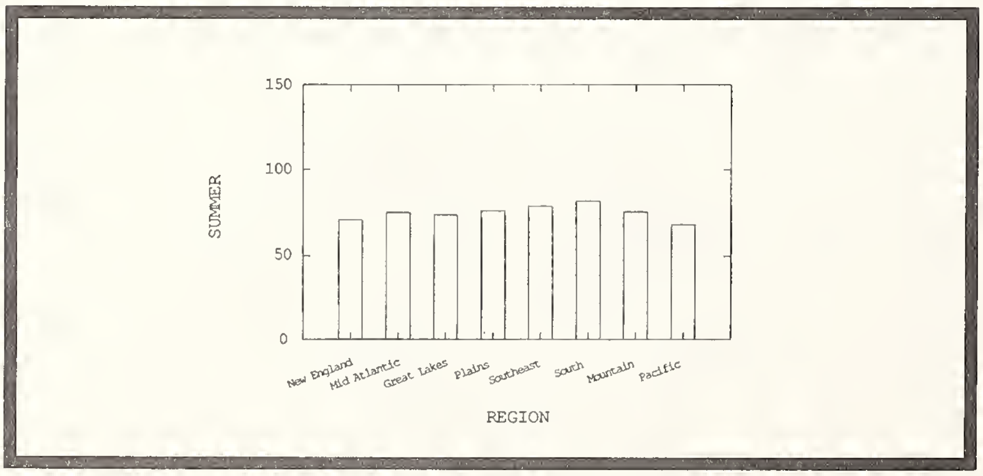


Figure 3B

In this case, the height of each regional bar represents the average regional summer temperature based upon the values of the variable SUMMER for each region. The YMIN option instructs SYGRAPH to begin the vertical axes at zero; without this specification, SYGRAPH would rely upon its own scaling routines. Summer and winter averages are presented on a single bar chart in Figure 3C. The BAR statement in this case includes the additional variable name, WINTER. The FILL= option is used to enhance the graph with patterned bars.

```
BAR SUMMER,WINTER*REGION$ / FILL=7,4,YMIN=0
```

Finally, the graph of *Figure 3D* is used to compare the average regional summer temperatures with the national average of 75.6 degrees Fahrenheit, specified in the BASE= option. The additional LIMIT= specification is used to draw the horizontal line at the value specified by the BASE. The use of this option is somewhat confusing. Because the use of LIMIT allows one to mark both upper and lower limits on a graph, two limits must always be specified. The line we wish to draw is specified at 75.6, in addition we specify that a line be drawn at the value -2, which is out of the range of SUMMER values and will therefore not be drawn. This graph also illustrates SYGRAPH's facility to draw "negative" bars. Labels and titles have also been specified in the source code for this bar chart, as follows:

```
BAR SUMMER*REGION$ / BASE=75.6 LIMIT=-2,75.6,
  TITLE='SUMMERTIME AVERAGES',
  XLABEL='REGIONAL GROUPING',
  YLABEL='AVERAGE SUMMER TEMPERATURE'
```

Icon Graphs

Turning now to more exotic alternatives, a variety of icon graphs can be produced within SYGRAPH. This type of display is useful for illustrating and exploring multivariate data. For illustration, a data set containing four measures of respiratory fitness for each of twenty male joggers has been used to create the icon histogram in *Figure 4A*. Each figure on the graph represents a bar chart of the values of the variables of interest which include three measures of heart rate along with a measure of run time. The commands used to create this graph are:

```
USE FITNESS
ICON   HRTREST HRTRUN HRTMAX RUNTIME / LABEL=ID$,
STAND, HIST
```

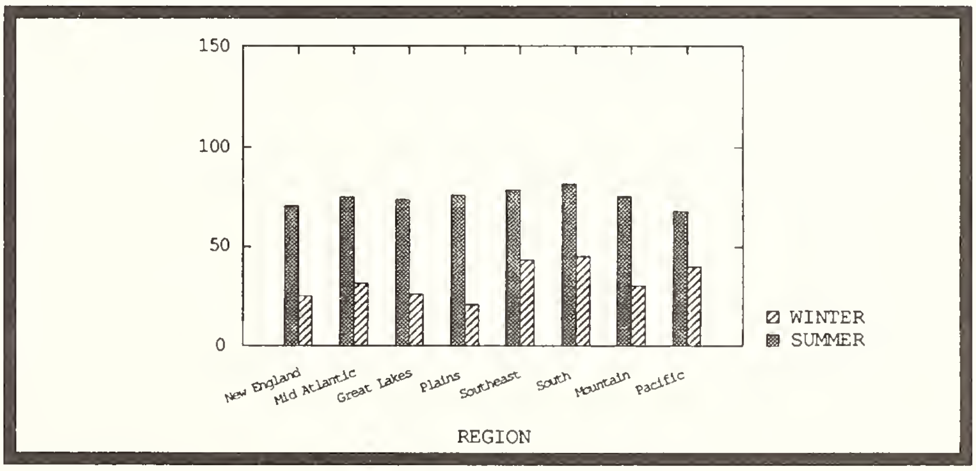


Figure 3C

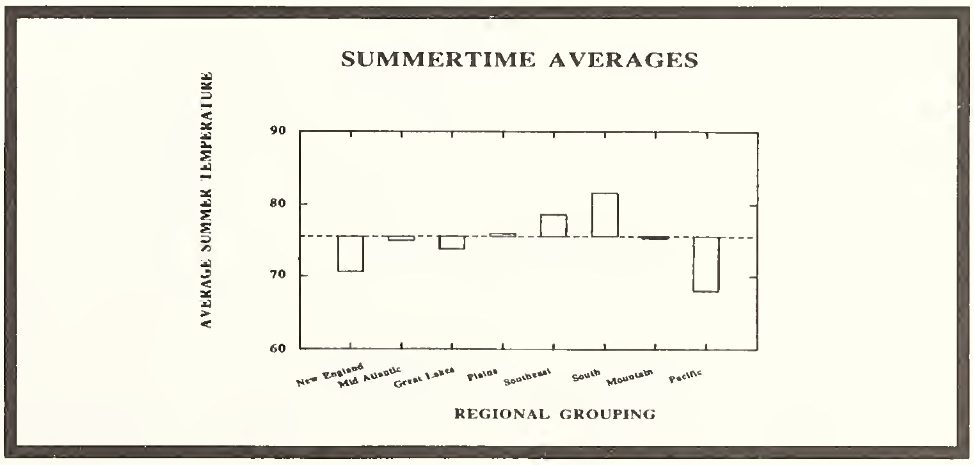


Figure 3D

The variables HRTREST, HRTRUN, HRTMAX, and RUNTIME have been standardized through use of the STAND option to make values originally measured on differing scales comparable. The LABEL=ID$ specification has been used to print the value of the variable ID$ for each individual below his respective plot.

Figure 4B displays a second type of ICON graph, the Chernoff face display. In this type of presentation, each variable is associated with a facial feature. For example, the value of the first variable on the variable list will determine the curvature of the mouth for each face (i.e., case), while the second variable determines the angle of the brow. The underlying idea is that faces that appear to share a resemblance may represent cases more alike in their values than faces which appear dissimilar. In the figure, Chernoff faces have been drawn for the fitness data set.

*Figure 4*C represents another method of display for multivariate data. The code for producing this graph is:

```
SPLOM Canada,US,Japan,Germany,England*Year, / Smooth=Nexpo,
  Size=0
```

Here the SPLOM statement, an abbreviation for ScatterPLOt Matrix, has been used to create a single comparative display of five individual series of productivity statistics. The negative exponentially-weighted smoothing option has been selected for interpolation. The SIZE=0 option has been used to suppress the printing of the actual data points.

Idiosyncrasies of SYGRAPH

As expected in a package of this scope, SYGRAPH is not without its idiosyncrasies. Cutting and pasting the code for a graphic specification of two or more lines does not work as smoothly as in other Mac applications. Another source of frustration is the need to insert parentheses in mathematical expressions for no apparent reason. For example, SYGRAPH insisted that parentheses be placed around the expression 2*ASN(1) in the statement

PLOT Z=(COS(X^2+Y^2)/4) / (X^2+Y^2-(2*ASN(1))).

As well, in future releases, one would hope to see the ability to scroll vertically through graphic output, as only the lower portion of a long graph is visible on the screen in this version. Finally, the capability to save graphic output in a PostScript file would be a most welcome enhancement. In the current release, graphic output can only be saved in the lower resolution PICT format. PostScript output can be produced and printed, but not permanently saved. (To produce quality graphic output, the Laserwriter Optimizer choice must be selected from the Formats section of the Options window.)

Ease of Use

Aside from the above complaints, SYGRAPH is surprisingly easy to use. The majority of graphs can be produced with a single statement, with many available options for enhancements. In addition, the manual is a delight. It contains scores of sample graphs, each complete with the code needed to generate the example and explanation where required.

If you would like to learn more about SYGRAPH or the SYSTAT package, please contact Andrzej Pindor 978-5045.

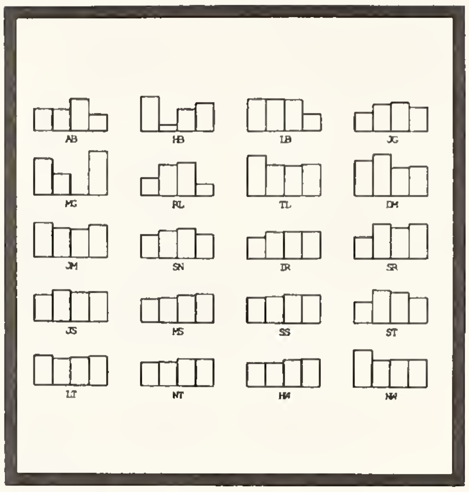


Figure 4A

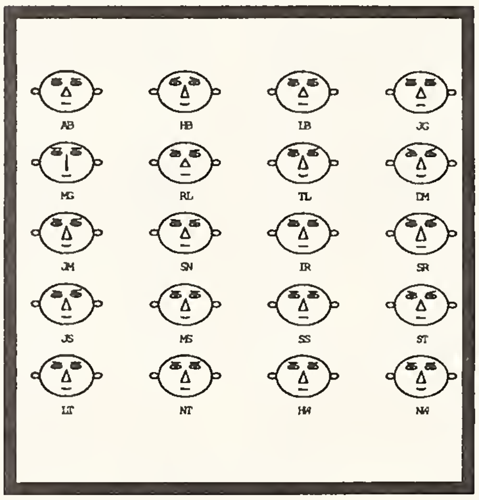


Figure 4B

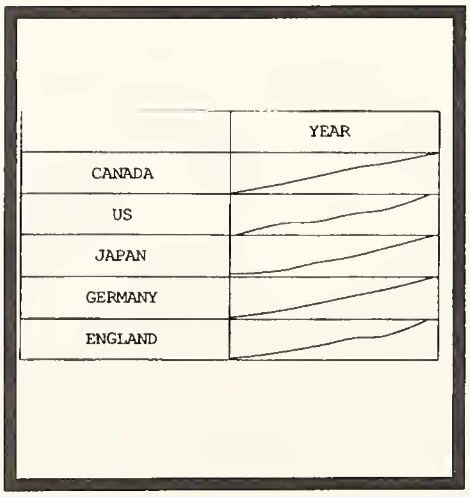


Figure 4C

Numerical and Scientific Software for Microcomputers

Andrzej Pindor
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Derive — A Mathematical Assistant

Derive, a successor to **muMATH**, is a symbolic manipulations program for IBM PC and compatible microcomputers. muMATH, reviewed in the November/December 1988 issue (#251) of *ComputerNews*, was released in 1983 and was based on the microcomputer technology available at that time. Since 1983, there has been enormous progress in microcomputer hardware and software development — new hardware allows programs to have features that were not available in the early 1980s. This has considerably heightened the expectations of users, who count on new programs to have a full selection of "bells and whistles." Derive meets these expectations, as you will see below.

However, although muMATH is older, it is still useful. muMATH features not only the programs performing various symbolic manipulation tasks, it also contains a language that can be used to formulate and solve symbolic math problems. This makes muMATH an open system that you can extend into an area of importance to you. Derive does not allow such extensions, but this should not matter to a general user.

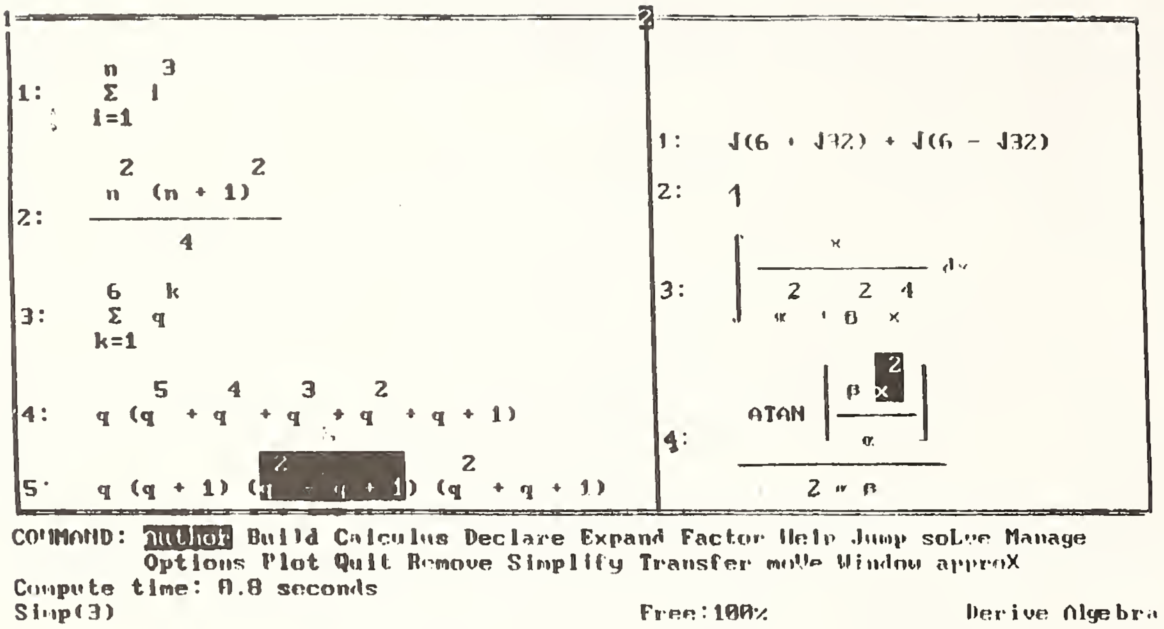
Major capabilities of Derive include:

- Exact arithmetic
- Approximate arithmetic to a desired degree of accuracy
- Integer factoring
- Complex number arithmetic
- Simplification of formulas
- Expand with respect to all or some variables
- Factor with respect to all or some variables
- Substitute values for variables and subexpressions
- Solve equations and inequalities algebraically
- Closed form finite and infinite sums and products
- Symbolic differentiation and integration
- Approximate numerical integration
- Finite and infinite limits
- Symbolic vector and matrix manipulations
- Full range of elementary functions
- A number of statistical and financial functions
- 2D and 3D plots of expressions
- Generate FORTRAN and Pascal compatible files

In spite of this wide range of capabilities, Derive fits on one diskette and can be run with only one floppy disk drive.

Derive is a menu driven program — when you enter the program, it presents you with a single window with a range of commands displayed at the bottom. You also see information about the percentage of memory that is free, and a message line displays what Derive is doing or what you are expected to do next. The message line also indicates how much time it took to perform your last task.

Initially, this line displays the message "Enter option", where you are expected to issue a command from the menu of options. If you decide to enter an algebraic expression, you are presented with a line below the main window where you enter the expression as you would enter it on a typewriter (that is, in a linear form, although you have a full range of Greek characters available). After you press the ENTER key, the expression appears in the window in a natural two-dimensional form, including special mathematical symbols. Once an expression has been entered, the whole expression



```
1
      n   3
1:    Σ   i
     i=1

       2        2
      n  (n + 1)
2:   ─────────────
          4

      6   k
3:    Σ  q
     k=1

          5    4    3    2
4:   q (q  + q  + q  + q  + q + 1)

                  2              2
5:   q (q + 1) (q  - q + 1) (q  + q + 1)

2
1:   √(6 + √32) + √(6 - √32)

2:   4

     ⌠      x
3:   │ ───────────── dx
     ⌡   2    2  4
        α  + β  x

              ⎡  2 ⎤
              ⎢ β x ⎥
         ATAN ⎢─────⎥
              ⎣  α  ⎦
4:      ──────────────
           2 α β

COMMAND: Author Build Calculus Declare Expand Factor Help Jump soLve Manage
         Options Plot Quit Remove Simplify Transfer moVe Window approX
Compute time: 0.8 seconds
Simp(3)                              Free:100%                Derive Algebra
```

Figure 1

or parts of it (which you highlight, as in Figure 1) can be manipulated at will. For example, it can be used for constructing a new expression.

Results collected in the main window can be scrolled up and down and rearranged. The results can also be saved to a file in a form that allows them to be used in a subsequent session or in a form suitable for including in a FORTRAN or Pascal program. As indicated above, Derive has two-dimensional and three-dimensional graphics capabilities with a useful range of features. The main window can be split into several windows, as shown in *Figure 1*.

In the first window of *Figure 1*, lines one and two demonstrate that Derive can perform sums to a symbolic limit. Line four is a result of the summation in line three, and line five is obtained by factoring the expression in line four. In the second window, lines one and two show that Derive is able to simplify complicated irrational expressions. Note that the expression in line one is exactly equal to 4, as given by Derive in line 2 (this can be seen by squaring the expression in line one). Finally, lines three and four show Derive's ability to find indefinite integrals.

At the bottom of *Figure 1*, we see the main menu with the current choice highlighted. Note the option **approX**, which allows approximate evaluation of the expressions. This performs, for instance, numerical integration. The line just below the menu tells us that the last task (the indefinite integral) took 0.8 seconds. In *Figure 2*, we see Derive factoring a large integer (lines one and two) and solving exactly a cubic equation (lines four to seven). The expression in line three is plotted in the second window, and the Plot menu is visible at the bottom of the windows.

Vendor: Soft Warehouse Inc., 3615 Harding Ave., Suite 505, Honolulu, Hawaii, 96816 USA

System Requirements: IBM PC, XT, AT, PS/2 or compatible running MS-DOS Version 2.1 or later; one of the following display adapters: MDA, CGA, EGA, VGA, Hercules or compatible; minimum 512KB of RAM (Derive can use up to 640KB); at least one double-sided floppy disk drive. There is also a version of Derive for NEC PC-9801 Personal Computers.

Price: US$200.00

Some Problems

Derive is fairly good at factoring, though it is by no means perfect. For instance, it will factor $x^{20}-1$ into
$(x-1)(x+1)(x^2+1)(x^4-x^3+x^2-x+1)$ *
$(x^4+x^3+x^2+x+1)(x^8-x^6+x^4-x^2+1)$,
but it is unable to factor
$(x^8+x^6+x^4+x^2+1)$
into
$(x^4-x^3+x^2-x+1)(x^4+x^3+x^2+x+1)$.

There are also a few small things that could be improved to make the product more satisfying for users. For example, to examine a long expression that does not fit on the screen, you can pan through it to the left or right. However, when you move to another expression, the previous one reverts to the original position, with the left-most part visible. This makes it difficult to visually compare two long expressions. Another shortcoming is that Derive does not offer any device drivers for plotting. The only way to get a hard copy of a plot is to do a screen dump, but this is not always a satisfactory solution. Online help should also be more detailed.

It is also unfortunate that Derive does not keep a log of your session. For example, in the first window of *Figure 1*, no note is kept to show the operation that was applied to arrive at expression five from expression four. Finally, while the manual is concise and unintimidating, at times we would have preferred a more detailed treatment of Derive using non-trivial examples.

In Conclusion

Derive is a well-designed, easy-to-use, and reasonably priced product. Considering the fact that it can run on machines with only 512 kilobytes of RAM, it has a lot of power; many owners of XT and AT compatibles will find it very useful.

Correction: The pricing for Dynamical Software in the January/February issue of *ComputerNews* was incomplete and incorrect. Here is the corrected information in full. We apologize for any inconvenience this error may have caused.

Dynamical Software Information

Dynamical Software is a product of Dynamical Software Inc., P.O. Box 35241, Tucson, Arizona 85740 USA

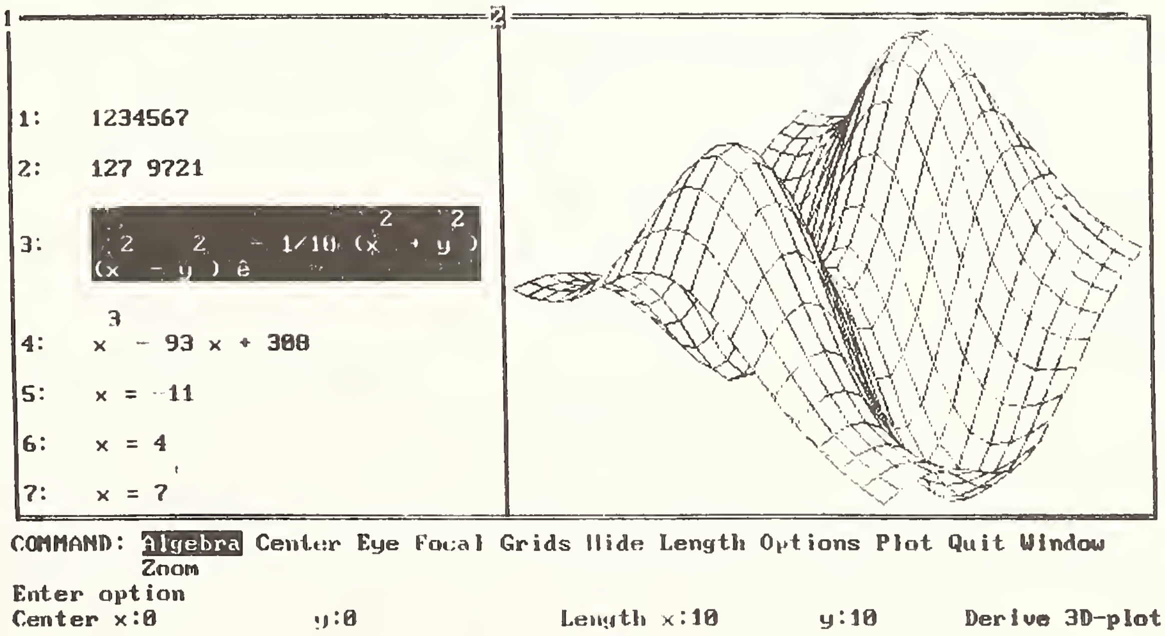
System requirements:

IBM PC compatible microcomputer (XT, AT, and 80386-based machines, or Tandy 2000) with 640KB of RAM, graphics card (CGA, EGA, Hercules, Vega Video Deluxe, Tandy 640x400) and FORTRAN Compiler (Microsoft or Ryan MacFarland). A hard disk, numeric coprocessor, and Microsoft-compatible mouse are recommended but not required.

Pricing:

The **DS I** diskette costs US$250 and **DS II** US$350. Both diskettes together cost US$550.

Dynamical Software, Inc. offers considerable discounts for multiple copy purchases. For instance, if you purchase five copies, the price per copy (including shipping) would be about US$485, for ten copies about US$415, and even lower for multiples over ten. A site license agreement is available also. UTCS is willing to organize a group purchase if there is sufficient interest. Please contact Andrzej Pindor at 978-5045 for details.



```
1:    1234567

2:    127 9721

                           2     2
       2     2   - 1/10 (x  + y )
3:   (x  - y ) ê

        3
4:    x   - 93 x + 308

5:    x = -11

6:    x = 4

7:    x = 7

COMMAND: Algebra Center Eye Focal Grids Hide Length Options Plot Quit Window
         Zoom
Enter option
Center x:0          y:0                Length x:10       y:10      Derive 3D-plot
```

Figure 2

Does My PC Need More Memory for Running SAS?

Andrzej Pindor
apindor@vm.utcs.utoronto.ca

In the early days of the microcomputer era, when DOS was being formulated, nobody could forsee the rapid progress in the development of hardware or the dramatic decrease in the price of chips that was to take place in the following years. As a result, programmers made decisions concerning the structure of DOS that led to the famous 640 kilobyte (KB) barrier, which is the inability of applications running under DOS to access memory beyond 640KB. (Remember that in those early days, 640KB of RAM seemed like infinity!)

When the price of memory chips plunged (this process recently came to a halt due to a conflict between American and Japanese chip manufacturers),ways were found to use memory beyond 640KB, but this extra memory can only be used for special purposes and/or by using special tricks. The 640KB barrier remains in place and will disappear only when DOS is replaced by the OS/2 operating system.

Many SAS/PC users ask if they need the additional memory and if it is advantageous when running SAS. Answers to these queries depend on the way you use SAS. SAS is designed to run on a microcomputer with 640KB of RAM (in principle, even 512KB are enough to run SAS, but only very small problems can be handled using this amount). However, SAS is a large system with extensive capabilities, and if you intend to stretch these capabilities to their limits, additional memory may help.

Before discussing where additional memory may be useful or necessary, let us point out that additional memory comes in two flavours, *extended* and *expanded*. As we shall see below, extended memory is generally less useful than expanded memory. Anyone purchasing additional memory should be aware of this fact.

You may need additional memory in the following situations:

1. You work with datasets involving a large number of variables, run complicated DATA steps, create complex graphs using SAS/GRAPH, and/or work with large regression or ANOVA models or the like. With only 640KB of RAM, SAS can handle datasets with no more than 750 variables. This number is reduced as the complexity of the SAS program increases.

2. You want to use the newest SAS module, SAS/ASSIST, which is a menu-driven interface for the SAS system. SAS/ASSIST makes the task of SAS programming much easier for people with limited programming experience.

3. You find that SAS jobs run too slowly for your taste. The additional memory may increase the speed, for reasons explained below.

Complex Programs

Release 6.03 of the SAS system for personal computers supports the use of expanded memory meeting LIM specifications Version 3.2 or later (EMS). With EMS, larger SAS programs can be executed and larger SAS datasets can be processed. However, similar gains can be achieved by running SAS programs noninteractively, that is, without the Display Manager. To use EMS support, you must first insert the following line at the beginning of your CONFIG.SAS file:

```
-EMS n
```

(**n** stands for a number from 1 to 512 that specifies 1 to 512 16KB pages of EMS.) If the line reads

```
-EMS all
```

all available EMS memory, up to 2MB, will be used. Then, you install optimized EMS images, as described in the SAS installation manual.

To run SAS noninteractively, you create a DOS ASCII file containing your program using any suitable editor (for instance, the PGM window of the SAS Display Manager). The extension of the filename should be ".sas". Then, from the DOS level , you issue the command **SAS *filename*** where *filename* is the name of the file containing the SAS program. (If SAS was used to create the file, the session should be closed.) After SAS finishes working on the program, a log of the job is written to a file called *filename.log*, and the results of procedures, if any, are written to a file called *filename.lst*.

To give an idea of the amount of space available for your program and data in different configurations, *Table 1* shows the size of workspace available when running PROC IML.

Table 2 gives the number of variables that can be handled in a short DATA step for different configurations.

	Mode of Operation	
Memory	**interactive**	**noninteractive**
640KB	100KB	210KB
640KB + 1MB(EMS)	360KB	400KB

Table 1

	Mode of Operation	
Memory	**interactive**	**noninteractive**
640KB	750KB	1050KB
640KB + 1MB(EMS)	1600KB	1775KB

Table 2

Running SAS/ASSIST

In order to use SAS/ASSIST, EMS is crucial. According to SAS Institute, you need at least 1MB of expanded memory to run SAS using SAS/ASSIST, and more is necessary if you intend to do complex statistics. However, it turns out that just to invoke SAS/ASSIST and use its menu-driven interface to build SAS programs, 200KB of EMS is enough. To run the programs you create, you have to leave SAS/ASSIST and use the Display Manager directly.

Increasing Speed

If SAS jobs seem to take forever, there are a number of measures that may increase speed. Not all require additional memory. In situations where you perform complex statistical analysis involving a lot of heavy calculations (e.g., PROC GLM for large models), you should first invest in a math coprocessor. Then, if you notice that there is a lot of hard disk activity when your jobs are running (i.e., the indicator light is almost constantly on), you should consider buying a disk with a shorter access time and/or upgrading your disk controller. UTCS' Microcomputer Support Group could advise you on these upgrades.

As a final measure, acquiring additional memory may increase the speed of your SAS jobs because access time for information residing in memory is much shorter than that for information on the hard disk. However, please note that the primary reason for installing EMS is to increase the size of problems that can be handled; there is no guarantee that there will be any increase in speed. In fact, many users report that SAS runs more slowly with EMS.

Nevertheless, you can speed up SAS if you use additional memory for a RAM disk (also known as a V-disk or virtual disk), or for a memory cache. A RAM disk is an area in either extended or expanded memory that is used as a very fast disk. It is different from a hard disk in that the information residing on it disappears when your computer is rebooted or switched off (or when the power fails!). Memory cache is an area of memory that is used, with the help of special software, to keep a number of the most recently utilized files (the number depends on the size of the cache) immediately available. When the program needs the file again, it does not have to wait for the file to be read from the hard disk. There are special programs that make extended memory act like expanded memory. Extended memory utilized this way tends to be very slow and we do not recommend such use. If you have extended memory, we suggest that you use it as a RAM disk. SAS Institute recommends that if you have 1MB or more of expanded memory, you should divide it evenly between EMS and memory cache.

Creating a RAM Disk

To use your additional memory as a RAM disk, you must first install a DOS command in the CONFIG.SYS file that creates a RAM disk when you start your computer. This procedure is described in your DOS manual.

Next, you must decide what you are going to keep on this RAM disk. Many users find it useful to keep SAS work files (i.e., a SASWORK subdirectory) on the RAM disk. The only problem with this approach is that if, in the course of your SAS session, the total size of the work files exceeds the size of the RAM disk, you will get a **DISK FULL** error, and SAS will abort. This is highly undesirable, so do not put the SASWORK subdirectory on the RAM disk unless the RAM disk is large enough for your session. A RAM disk of 1MB in size or larger is advisable. Also, monitor the size and number of work files during your SAS session.

An alternative is to put the most frequently used SAS executable files on the RAM disk. The files you choose depend somewhat on the type of work you are doing, but you should first consider the following files from the SASEXE\CORE subdirectory:

SASXKERN.EXE	(86KB)
SASYH.EXE	(81KB)
SASXDM.EXE	(22KB)
SASXED.EXE	(80KB)
SASMDSC.EXE	(107KB)
SASMDS.EXE	(15KB)
SASXZP.EXE	(11KB)
SASMDSR.EXE	(20KB)

Again, the number of files that you put on the RAM disk will depend on the disk's size. If there is a particular procedure that you use often, you might also consider putting the corresponding file on the RAM disk.

If you put work files or system files in the RAM disk, you have to tell SAS by modifying the CONFIG.SAS file. In the case of work files, you should change the line

```
-work saswork
```

in the section **Directory definitions**, to read

```
-worke:\saswork
```

Here we assume that your RAM disk is designated as the letter **e** in your CONFIG.SYS file. If your RAM disk is designated as a different letter, use the letter appropriate to your setup.

In case you decide to put SAS executable files on the RAM disk, you should add the following line before the one with comment "SAS executable files search order":

```
-path   e:\
```

As above, **e** should be replaced by the letter used to designate your RAM disk. You must also copy the corresponding executable files to the RAM disk before you start a SAS session. This can be done by preparing a small batch file that you would invoke before calling SAS.

If you would like to improve the performance of SAS on your computer, please call Andrzej Pindor at 978-5045 for more information on the measures described above.

A Mouse in Hand

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Mice are quietly taking up residence beside many computer keyboards. Defined as alternative input devices, mice act as substitutes for the keyboard. A mouse enables you to make changes to words, graphics, and applications on the screen simply by moving it about and clicking one or more of its buttons. This article will look at the growing importance of mice as an input tool for today's microcomputers.

Mice Increasing in IBM World

Mice are standard equipment on Macintosh computers — you cannot fully operate a Mac without one. On the other hand, most IBM PC users still don't need mice. Most PCs don't need mice because most programs available for PCs are designed to be used with keyboard commands, without input from a mouse. In August 1987, PC Magazine estimated that only eight to ten percent of PCs had mice attached. However, the same magazine reported that, as of February 1989, 25 percent of PCs were equipped with mice. (Not surprisingly, Alps Electric, which makes the best-selling Microsoft Mouse and the popular IBM PS/2 "pointing device" (i.e., mouse), had a profit jump of over 100% from 1987 to 1988.) Why the sudden increase in people using mice with their PCs? The answer lies in the growing popularity of software that uses the mouse. Such software has existed for a number of years, but it was not widely used on PCs until recently.

Apple Is Big on Mice

Apple Macintosh microcomputers, all of which use mice, compete head-to-head with PCs. Macs are popular partly because you don't have to memorize a lot of keyboard commands to operate one, unlike most PCs. The Mac operating system and applications on Macs use screen images (called icons), dialogue boxes, and pull-down menus that are primarily accessed with a mouse. Because Macs use these graphical images, they are said to have a graphical user interface. Most PC packages, on the other hand, are operated from the keyboard through a *text-based user interface.*

Central to the graphical user interface is the mouse. The mouse is used to point at the various icons and words that you need for operating your software package. Because it is used to point at objects and words on the screen, it is classed, along with a number of alternative input devices, as a *pointing device.* The theory behind pointing devices is that because they let you point directly at an object or word on the screen, they are more natural and intuitive to use than keyboard commands.

Seeing the growing popularity of the graphical user interfaces found on Macintoshes and on a few other brands of microcomputers, software vendors began to incorporate the graphical interface in software programs for PCs. For example, PageMaker, an award-winning and very popular desktop publishing program, is graphics-based and makes heavy use of the mouse. It was first created for the Macintosh and became so popular that Aldus, PageMaker's creator, released an almost identical version for PCs.

More Power Needed for Graphical Interfaces

Despite the appeal of graphical interfaces, many popular programs still use text-based interfaces. Much of the slow spread of programs with graphical interfaces stems from the inability of many PCs to handle the heavy processing demands and specific hardware needs of these programs.

When you make changes in a graphical application, there is actually a lot of computing going on behind the scenes to make what you are doing look clean and simple. To handle these hidden computations, your computer must have more power than many of the early PCs. PageMaker can run on a PC-XT, but it would run so slowly that it would be frustrating to use for desktop publishing. To run PageMaker at an acceptable speed, you need a PC-AT, which is a newer, faster (and more expensive) design than the XT.

Graphical software developed for the many new PCs that have graphics capabilities includes Presentation Manager, the new operating environment for use with OS/2, and Microsoft Windows, an operating environment for use with DOS. Both of these programs will probably be very widely used in the coming years (Windows is already installed on over 600,000 PCs), and both are designed to be used with a mouse. It is interesting to note that both environments are very similar to the Macintosh desktop environment.

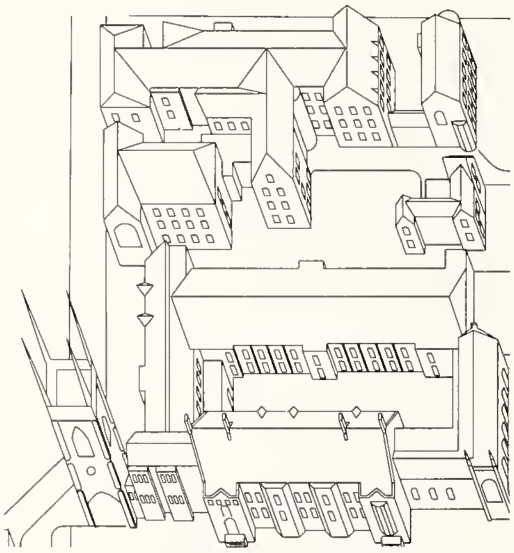
Inside the Mouse

In most programs with graphical interfaces, you use the mouse to move an image of an arrow (or other

Other Pointing Devices

While mice are the most popular pointing devices, they are not necessarily the most useful for special jobs. Other pointing devices include *touch-screens*, *trackerballs*, and *light pens*.

While these alternative input devices are not as popular as mice, each one has some advantages over mice. If a mouse is a more intuitive input device than a keyboard, then a touch-screen is even more so; if you want to choose an option on the screen, you simply reach up and touch it with your finger. Sensors in the screen detect the location of your finger. Light pens are better drawing tools than mice; they allow you to trace designs on the screen or on a tablet in the same way as on a piece of paper. Sensors in the screen or pad detect the position of the pen. Unlike the mouse which you move around, trackerballs stay in one place while you spin a ball that is set in a housing—spin the ball left and your pointer moves to the left. You don't need as much desk space for a trackerball as you do for a mouse.



Mice Are Not Best For CAD

One application where the mouse is not widely used is CAD (Computer Aided Design, Drafting, and Drawing). For CAD packages such as AutoCAD or VersaCAD, a pointing device called a *puck* or *digitizer* is used with a *digitizing tablet*. In the October 1988 issue of *ComputerNews*, we reviewed a project at the Office For Space Management that uses VersaCAD for computerizing drawings of buildings on campus. To enter these drawings, a technician places the cross hairs of a digitizing puck on points in a drawing and clicks a button on the puck; the tablet (it looks like a small drafting table) under the drawing records the position of the puck's cross hairs and feeds the information to the computer. The computer can then connect curved or straight lines between the points. The drawing of Hart House, done at the Office for Space Management, is a good example of the type of work for which CAD packages can be used.

For most applications, however, mice are considered to be more versatile and practical than most devices. If you were to buy an alternative input device, it would probably be a mouse.

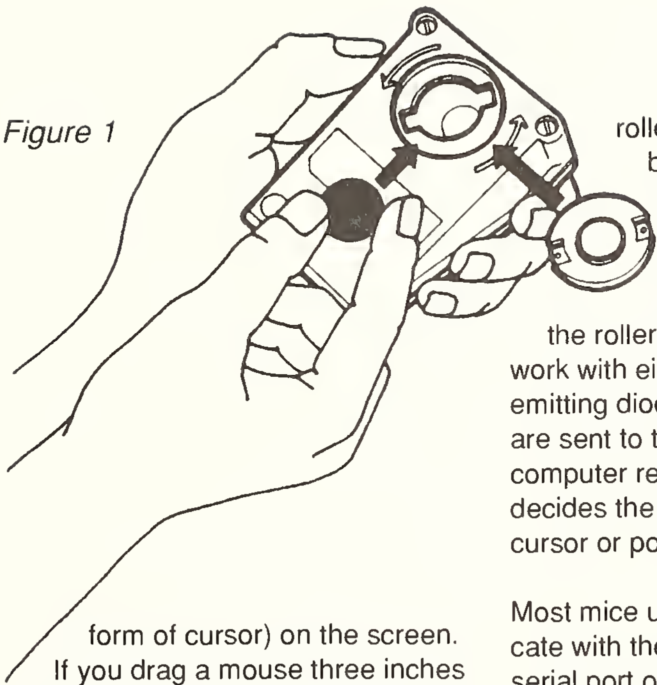


Figure 1

form of cursor) on the screen. If you drag a mouse three inches to the left, the arrow on the screen moves a relative distance and direction. The arrow may move more than three inches if you drag the mouse quickly. Some mice incorporate a feature called *ballistic tracking*. This means that a quick movement with the mouse causes the arrow on the screen to travel further than a slow movement. This is a handy feature because it allows you to move the arrow around the screen quickly, but it also gives you the option of controlling the pointer's fine movements.

The mouse detects movements across your desk through a roller ball (as in Figure 1), wheel, or light beams, depending on the type of mouse you buy. Most mice use a steel ball that is coated in rubber. When the mouse is moved, the ball, which protrudes slightly from the mouse's underbelly, rotates. Two rollers, pressed against the ball inside the mouse, turn when the roller ball does. These rollers are attached to small disks, which spin when the rollers do. These disks then work with either contact bars or light emitting diodes to create signals that are sent to the computer. When the computer receives the signals, it decides the relative position of the cursor or pointer.

Most mice used on PCs communicate with the computer through a serial port or a bus connection. Before you buy a mouse, you have to decide how you want to connect it to your computer. If you buy a bus version, you will have to install a board in your computer's bus. The board comes with the mouse and is usually easy to install. You then plug the mouse into a connector on the board. The advantage of a bus mouse is that you don't need a serial port. Most microcomputers have only one serial port, and many people prefer to leave this free for making connections to printers and modems. However, if you don't have a free slot for the bus board, then the serial mouse is your only option. It is interesting to note that IBM, finally bestowing its blessing upon the use of pointing devices, provides a dedicated mouse port in its new PS/2 microcomputer line. This means that you don't have to use a bus slot or serial port when using mice with PS/2s.

Do You Need One?

Mice are useful with a small (but growing) number of programs. If you are planning to get one of those programs, then you should start looking for a mouse. You can also purchase mouse drivers for many popular brands of software. For example, you can buy drivers to make mice work with WordPerfect, Lotus 1-2-3, and so on. Microsoft, recognizing that people won't buy mice unless they own software that uses mice, sells mice bundled with software. You can buy the Microsoft Mouse with Windows/286 and PC Paintbrush for Windows, with EasyCAD 2, or with Microsoft Paintbrush.

Remember that most programs that use mice are designed to work on AT-class computers (or better) with graphics capabilities. If you own a lesser computer (such as an XT or original PC), you may have a hard time finding programs that can use mice and that will work well on your computer (Microsoft Word is a notable exception). Do-it-yourself types have the option of writing their own menus for the programs they have — several mice ship with menu-generators to let you add mouse-driven menus to all your applications. The following article looks at a mouse that features a menu-generator and compares this mouse with another popular brand.

Of Mice and Leaping Einsteins

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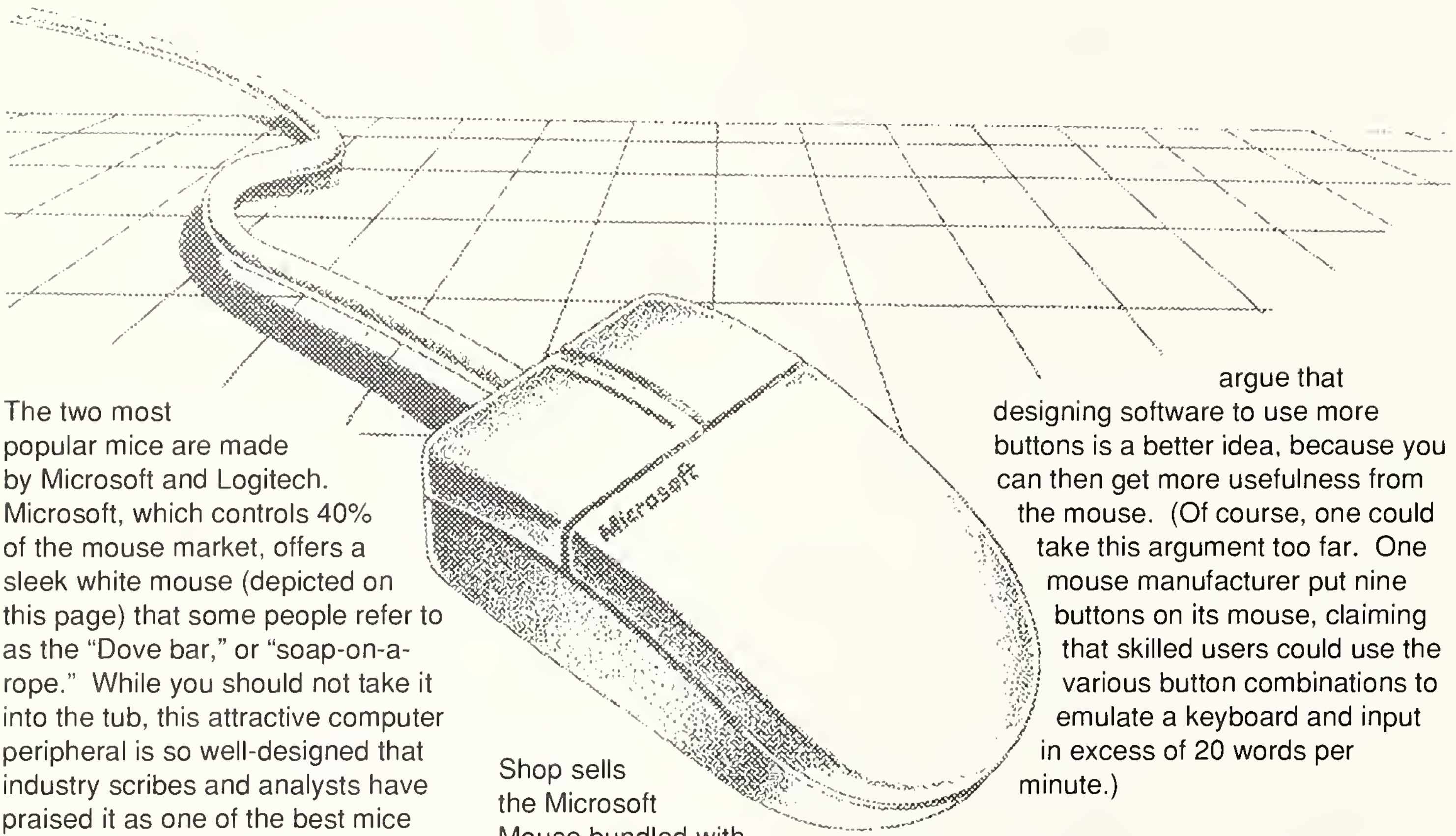


The two most popular mice are made by Microsoft and Logitech. Microsoft, which controls 40% of the mouse market, offers a sleek white mouse (depicted on this page) that some people refer to as the "Dove bar," or "soap-on-a-rope." While you should not take it into the tub, this attractive computer peripheral is so well-designed that industry scribes and analysts have praised it as one of the best mice available.

This model has a smooth, well-balanced feel, and, unlike most other mice, the rolling ball which tracks movement is located near the front instead of the rear. This design enhances the accuracy with which you can control cursor movements on the screen. Another feature, almost guaranteed to build its market strength, is the PS/2 connector supplied with Microsoft's serial mouse. Because the IBM mouse is a rather clunky contraption with an old-fashioned appearance, many of the millions of people using PS/2s will probably choose the good looking Microsoft mouse over IBM's. The University of Toronto Computer Shop sells the Microsoft Mouse bundled with Windows/286 software for $189 and with Microsoft Paintbrush software for $125.

One Size Fits All

Logitech builds mice that are, in many ways, more useful than Microsoft's. First, most Logitech mice have three buttons (as in *Figure 1*) instead of the two available on Microsoft mice. The extra button means you have seven possible button combinations instead of the three combinations possible on a two-button model. For most applications, two buttons are enough. However, some people argue that designing software to use more buttons is a better idea, because you can then get more usefulness from the mouse. (Of course, one could take this argument too far. One mouse manufacturer put nine buttons on its mouse, claiming that skilled users could use the various button combinations to emulate a keyboard and input in excess of 20 words per minute.)

Second, Logitech bundles a programming language called POINT with its mice. While most people would probably never use POINT, this is a relatively easy-to-use tool for creating mouse menus for programs that don't support the use of a mouse. Logitech includes POINT programs that make Lotus 1-2-3, DOS, and other applications work with its mouse. (It is arguable whether experienced users would need these programs. It is often faster to use memorized keyboard commands for routine actions than it is to reach for the mouse. In fact, even in mouse-based applications, experienced users usually find they can work faster by using keyboard short-cuts for many routine operations.)

Third, Logitech offers a mouse that is specially suited for desktop publishing, CAD, and other work on high-resolution monitors. Called the *HiRez Mouse*, this model works at a resolution of 320 dots per inch (dpi), whereas almost every other mouse on the market works at 200 dpi. This means that the HiRez mouse detects onscreen changes as small as 1/320th of an inch, which is an advantage when doing fine movements on a high-resolution monitor. On a low-resolution CGA monitor, not much difference is noticeable between the HiRez and other mice.

The added features on Logitech mice seem to be aimed at people who want to get more out of their system than the average user. However, even though you might never use POINT, the extra button, or the extra resolution, you won't be wasting money on these features; the Logitech HiRez Mouse sells for a competitive $130 at the U of T Computer Shop. As an added bonus, Logitech last month released a new ergonomic design for their mice that bears a suspicious resemblance to Microsoft's "Dove bar." Advertized together with a painting of Einstein, who is depicted wearing a leotard and ballet slippers and leaping across a purple backdrop, this sleek model is touted as "a mouse with an extraordinary body and a mind to match." ▨

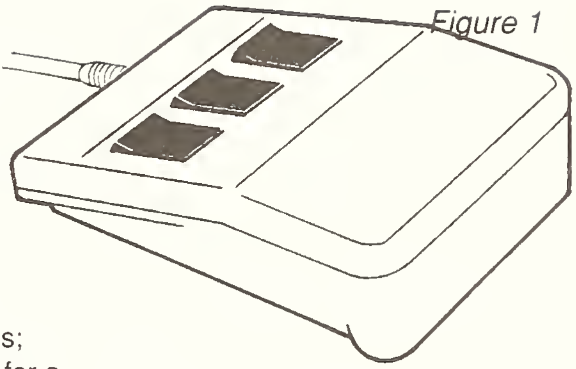
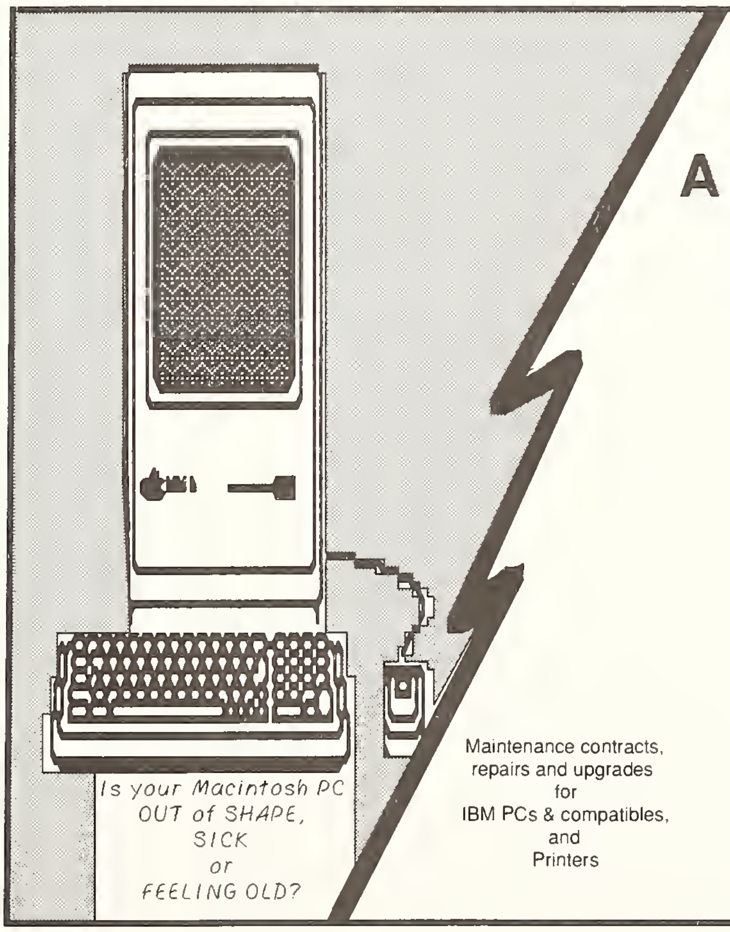


Figure 1



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Noncredit Short Courses

Irene Rosiecki
rosiecki@vm.utcs.utoronto.ca

This is the current course schedule for UTCS noncredit Short Courses. If you are interested in attending one of these sessions, or if you would like more information about courses, please call 978-4565.

Microcomputer Concepts (PC)
April 5, 1989
9:00-12:00 noon

Introduction to dBASE III Plus
April 10-14, 1989
2:00-5:00 p.m.

Introduction to dBASE IV
May 29-June 2,1989
2:00-5:00 p.m.

Desktop Publishing Seminar
April 18, 1989
10:00-3:00 p.m.

Introduction to DOS
June 19-23,1989
9:00-11:00 a.m.

Electronic Mail Seminar
April 5, 1989
2:00-3:30 p.m.

May 24, 1989
2:00-3:30 p.m.

Introduction to Excel on the Macintosh
June 5-9,1989
2:00-5:00 p.m.

HyperCard Seminar
March 3, 1989
10:00-3:00 p.m.

March 20-21, 1989
10:00-12:00 noon

Introduction to Lotus 1-2-3
May 15-19, 1989
2:00-5:00 p.m.

Introduction to PageMaker
April 24-28, 1989
1:00-3:00 p.m.

ProComm Communications Seminar
April 5, 1989
12:00-2:00 p.m.

Introduction to SAS on the PC
April 24-28, 1989
3:00-5:00 p.m.

Intermediate Applications of SAS on the PC
June 19-23, 1989
2:00-5:00 p.m.

Introduction to Microsoft Word (PC)
April 24-28, 1989
9:00-12:00 noon

Introduction to Microsoft Word (Macintosh)
April 10-14
1:00-5:00 (April 10)
1:00-4:00 (April 11-14)

May 15-19, 1989
1:00-5:00 p.m. (May 15)
2:00-5:00 p.m. (May 16-19)

Introduction to WordPerfect Version 5.0
March 13-17, 1989
12:00-3:00 p.m.

April 10-14, 1989
9:00-12:00 noon

May 15-19, 1989
9:00-12:00 noon

Advanced WordPerfect 5.0
June 5-9, 1989
9:00-11:00 a.m.

Introduction to WordPerfect Version 4.2
March 13-17, 1989
9:00-12:00 noon

April 24-28, 1989
12:00-3:00 p.m.

Advanced WordPerfect 4.2
April 10-14, 1989
12:00-2:00 p.m.

WordPerfect 5.0 Update

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If you are using WordPerfect 5.0, you are probably aware of the problems or "bugs" in the original May release and the follow-up July "maintenance" release. The bug eradication process has been long and problematic, with interim releases appearing in September, October, and November (that we know of). How are you, a typical WordPerfect 5.0 user, affected by the multiplicity of Versions 5? If you have been the victim of any of the bugs, you already know the frustration and anxiety of using WordPerfect. To eradicate the problem, you must move to a bug-free release. If you have not experienced any problems while using WordPerfect 5.0, you should also update your copy to the most recent release of the software so that your software remains current.

Deciding to Update

If you are using the May or July releases of WordPerfect 5.0 you should obtain the most recent update as soon as possible. See "Updates Available at UTCS" sidebar. To see the date of your version of WordPerfect, press the F3 (HELP) key while in the WordPerfect program. The date of your copy will be shown in the top right corner of the Help screen.

If you own a legal copy of WordPerfect 5.0 you may obtain the November 15 update from UTCS at no charge. To receive the update you must make an appointment with Mary Wilson at 978-5601. You must bring your original WordPerfect 5.25-inch disks, sufficient blank disks for the update (twelve 5.25-inch, six 3.50-inch) and your serial number in order to receive the update. This updating procedure has been arranged with the generous permission of J.B. Marketing, the Canadian distributor of WordPerfect.

If you are using the September 16, September 23, or October 10 releases you may choose to update at a more leisurely pace — but you should make the change nonetheless.

Impact of Update

The releases of WordPerfect constitute revisions on a number of levels. Between the May and July releases the portions of the program handling printer definitions were rewritten; user-defined or modified printers created with the May release cannot be used with the July release. In addition, font and print settings for documents created in these earlier releases change when the documents are retrieved in later releases.

In later releases the Graphics functions have been revised, making previously unreadable graphics files readable. The main spelling dictionary has been revised at least three times, each time introducing new, different spell-checking errors. Footnote problems are partially solved in the October release and finally resolved in the November release.

The magnitude of the changes means that you must usually replace all of your WordPerfect program-specific files when you install an update. Documents created in earlier releases of WordPerfect should be retrieved into the new version and checked, by using Reveal Codes and by printing, for subtle differences. Program customization using Setup (Shift-F1) will have to be redone. Customization of printer definitions may be lost.

List of Major Changes

To assist you in determining where revisions have been made in WordPerfect, we have culled this list from Volume 3 of *The WordPerfectionist*, the WordPerfect Support Group Newsletter. The complete list describes over 200 changes and is too large to reproduce here. Contact the UTCS Text/Imaging Group at 978-4548 if you wish to view the entire list in *The WordPerfectionist.*

Auto Reference
Errors resulting from referencing paragraphs that have unusual numbering styles fixed in September 16 release.

Block
Unexpected cursor movement while blocking text and bolding text fixed in September 16 release.

Center
Premature line endings when centring existing text fixed in September 16 release.

Columns

Problems with screen display while editing columns fixed.

Cursor

Documents will no longer disappear when using Home-Home-Up arrow (limited to certain computer types). Fixed in October 7 release.

Display Colours/Fonts/Attributes

Inconsistencies with some EGA/VGA cards have been eliminated in October 7 release.

Error Handling

Error messages are now explicit; DOS errors no longer require pressing Cancel twice to exit (September 16 release).

Expanded Memory

When running under Shell, with the /V switch, WordPerfect now allocates all available memory to itself (September 16 release).

Footnotes

Two footnotes occurring on the same line no longer cause a “Divide Overflow message. Footnotes using extended characters for numbering will now display correctly in Reveal Codes (September 16 release).

Graphics

EPS graphics files handled better. Conversions for HPGL, PC Paintbrush 2.8, and CGM files corrected.

Default Figure and Table captions will have correct capitalization.

Scaling graphics will display correctly.

Improved handling of errors; explicit error messages in September 16 and November 15 releases.

Headers/Footers

Problems using graphics and text boxes in headers and footers have been fixed in September 16 and November 15 releases.

Help

International versions of WordPerfect request the licence number be entered the first time you use the program.

Hyphenation

Pressing the space bar will no longer end a manual hyphenation request. The Exit key (F7) will temporarily disable hyphenation during formatting or cursor movement requests (September 16 release).

Initial Codes

The cursor is now placed after existing codes when entering Initial Codes both in Setup and in the document (September 16 release).

List Files

List files screen will automatically update after file operations such as Copy or Rename (September 16 release).

Merge

Merge detects and disallows invalid 5.0 merge files. Merge now allows 4.2 merge files (September 16 release).

Print

Font updating is faster.

The default form is now the standard paper size for the country in foreign language packages.

Manual feed printing will now print the last line of a page before prompting to insert a new sheet of paper.

Margins on rotated pages and landscape pages are now adjusted correctly.

Right justification will not affect the printing of overstrike characters or diacriticals.

Retrieve

Conversions from 4.2 to 5.0 generally improved, particularly with footnotes, paper size, and selected printer information (October 7 release).

Setup

Defaults for binding width, number of copies, graphics and text quality can now be changed in Setup (September 16 release).

Spell

Spell invoked in Reveal Codes will revert to full screen view.

Spell checks dictionary in use before ignoring “s” of plurals.

Apostrophes, single quotes, extended characters following a number, misspelled words to the left of graphics boxes, and target and index marks now treated correctly in November 15 release.

For assistance or more information about updating your version of WordPerfect 5.0, contact Geoff Rockwell at 978-4548.

Printers Supported in WordPerfect 5.0

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Geoffrey Rockwell
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Many of you are still trying to determine if WordPerfect 5.0 supports your printer. To find out, look for your printer in this alphabetical list and if you find it, make a note of the disk number listed next to it. Printer definitions for the printers listed here are available from UTCS. For more information, contact Geoffrey Rockwell at 978-4548.

Please note: All printer definitions on disk eight are contributed by WordPerfect users and are not supported by WordPerfect. You may use them at your own risk.

Printer Name	Disk Name
Acer LP-76	10
Alphacom Alphapro 101	9
Alps ALQ200/300/P2400C	3
Alps ALQ224e/324e	8
Alps P2000/P2100	7
AMT Office Printer (Diablo)	7
AMT Office Printer (IBM Color)	7
Apple ImageWriter / DMP	7
Apple ImageWriter II	7
Apple LaserWriter Plus/IINT/IINTX	2
AST TurboLaser	4
AST TurboLaser/PS	2
AT&T 495 Laser Printer	10
AT&T 7500S Typewriter	9
Blaser	4
Brother Corr-50/CE-50/Exec-65+IF-50	8
Brother HR-15XL/20/35/40	2
Brother M-1509	8
Brother Twinriter 6	2
C.ITOH 8510+NLQ	8
C.ITOH C-310 CP	3
C.ITOH C-310 EP/CXP	3
C.ITOH C-715F	3
C.ITOH C-815	3
C.ITOH CI-3500 Triprinter	8
C.ITOH D10-40	9
C.ITOH F10-40/-55/Strwrtr/Prntmstr	9
C.ITOH JET-SETTER II	10
C.ITOH ProWriter 8510	7
C.ITOH ProWriter jr. Plus	7
Canon AP800	9
Canon BJ-130	2
Canon LBP-8 A1/A2	4
Canon LBP-8II/LBP-8IIT	4
Centronics 351	7
Centronics GLP II	7
Citizen 120D/180D	3
Citizen 5200/5800	3
Citizen MSP-15	7
Citizen MSP-25	7
Citizen MSP-45/55	3
Citizen Premiere 35	2
Citizen Tribute 124/224	3
Commodore MPS 1250	7
Copal Writehand 6800	8
Cordata LP300	8
Cordata LP300X	4
Cosmo World Adeus CP-2000	9
Daisy Systems M45-Q	9
Daisywriter 2000	9
Data General 6321	9
Dataproducts DP Series	9
Dataproducts LZR-1230	1
Dataproducts LZR-1260	2
Dataproducts P132	7
Dataproducts SPG 8050	7
Destiny LaserAct I	10
Destiny PageStyler	9
Diablo 620	2
Diablo 630/630 ECS	2
Diablo 635	2
Diablo D80IF	9
Diconix 150	9
Diconix 300w	9
Digital LA50	7
Digital LN03	4
DOS Text Printer	3
EiconScript	9
Epson EX-800	3
Epson FX-80/100	7
Epson FX-85/286	7
Epson FX-86e/286e	3
Epson FX-850/1050	3
Epson GQ-3500	4
Epson JX-80	8
Epson LQ-500	3
Epson LQ-800	7
Epson LQ-800 Enhanced	8
Epson LQ-850/1050	3
Epson LQ-1500	7
Epson LQ-2500/2550	3
Epson LX-80	7
Epson LX-800	7
Epson MX-80 Graftrax	7
Epson RX-80	8
Facit 4512	7
Florida Data Office Sys 130	7
Fortis/Dynax DH45	9
Fortis/Dynax DM1310	3
Fortis/Dynax DM2015	3
Fortis/Dynax DX15/21/25/41	2
Fujitsu DL2400/DL2600/DL3400	3
Fujitsu DL3400	8
Fujitsu Dotmax 24D	7
Fujitsu DX2200 (Type F)	7
Fujitsu DX2200 (Type I)	7
Fujitsu SP 320	9
Fujitsu SP 320	9
HP 2603A	9
HP 2603A	9
HP DeskJet	2
HP LaserJet	1
HP LaserJet 2000	10
HP LaserJet II D	1
HP LaserJet Series II (Additional)	5

Printer Name	Disk Name
HP LaserJet Series II	1
HP LaserJet+, 500+ (Additional)	5
HP LaserJet+, 500+	1
HP PaintJet	2
HP PaintJet	2
HP QuietJet Plus	9
HP QuietJet Plus	9
HP RuggedWriter	2
HP RuggedWriter	2
HP ThinkJet	2
HP ThinkJet	2
IBM Color JetPrinter	9
IBM Color JetPrinter	9
IBM Color Printer	7
IBM Pageprinter 3812	4
IBM PC Graphics Printer	7
IBM Personal Pageprinter 4216	2
IBM Personal Pageprinter 4216	2
IBM Proprinter	3
IBM Proprinter II	3
IBM Proprinter with fonts (v. 2)	8
IBM Proprinter X24/XL24	3
IBM Proprinter XL	3
IBM Quickwriter (Additional)	7
IBM Quickwriter	3
IBM Quietwriter 7/8	9
IBM Quietwriter 7/8	9
IBM Quietwriter I (Old EPROM)	9
IBM Quietwriter I	9
IBM Quietwriter II	2
IBM Quietwriter II	2
IBM Quietwriter III (Additional)	9
IBM Quietwriter III	2
IBM Quietwriter III	2
IBM Wheelprinter 5216/5218	2
IBM Wheelprinter 5216/5218	2
IBM Wheelprinter E	9
IBM Wheelwriter 3/5/6	8
JDL-850	7
Juki 5510	7
Juki 6000	9
Juki 6100	8
Juki 6300	2
Juki 6300	2
Kyocera F-1000A/1010/2010/3010	10
LaserImage 1000	1
LaserPro Silver Express	10
Mannesmann Tally MT290	3
Mannesmann Tally MT910	10
NEC Pinwriter P2/P3 (6302)	7
NEC Pinwriter P2/P3 (6303)	7
NEC Pinwriter P5/P9XL	3
NEC Pinwriter P6/P7	3
NEC Pinwriter P2200	3
NEC Pinwriter P5200/P5300	3
NEC Silentwriter 850	8
NEC Silentwriter LC-860+	1
NEC Silentwriter LC-890	2
NEC Silentwriter LC-890	2
NEC Spinwriter 2050	9
NEC Spinwriter 3510/3530	9
NEC Spinwriter 3550	2
NEC Spinwriter 5515	9
NEC Spinwriter 7715	9
NEC Spinwriter 7730	8
NEC Spinwriter 7730	9
NEC Spinwriter 8830/ELF-360	2
NEC Spinwriter 8850	2
Nissho NP-910	7
Nissho NP-2410	7
NLQ LPRINTer SC-1200	7
NLQ LPRINTer SC-1500	7
Okidata LaserLine 6	1
Okidata ML 84 (IBM)	7
Okidata ML 84	7
Okidata ML 92/93 (IBM)	7
Okidata ML 92/93	7
Okidata ML 192 (IBM)	7
Okidata ML 192	7
Okidata ML 192+	3
Okidata ML 292 (IBM)	3
Okidata ML 292	3
Okidata ML 320 (Epson)	3
Okidata ML 390	3
Okidata ML 393/393C	3
Okidata Pacemark 2410 (IBM)	7
Okidata Pacemark 2410	7
Okimate 20 (IBM)	7
Olympia Compact RO	9
Olympia ESW 2000	9
Olympia Laserstar 6	1
Olympia Startype	9
Panasonic KX-P1080i	3
Panasonic KX-P1091	7
Panasonic KX-P1091i	3
Panasonic KX-P1092	7
Panasonic KX-P1092i	3
Panasonic KX-P1524	3
Panasonic KX-P1592	3
Panasonic KX-P1595	3
Panasonic KX-P3131/3151	2
Panasonic KX-P4450 Laser Partner	10
PostScript 1	6
PostScript 2	6
Primage 90-GT	2
Printronix S7024	7
QMS Kiss	4
QMS Kiss Plus (Module 20/30)	4
QMS Lasergrafix 1510	4
QMS PS Jet +/800 II/810/JetScript	2
QMS Smart Writer	8
Quadram Quadlaser	4
Qume LaserTen Plus	4
Qume Letter Pro +/Sprint 11/55 +	2
Qume ScripTEN	2
Ricoh LP4080R	4
Ricoh PC LASER 6000	4
Seikosha SP-1000I	7
Silver-Reed EXP 400	8
Silver-Reed EXP 500/550/800	2
Smith Corona TPI/TPII	8
Smith Corona XE 6100	9
Standard Printer	3
Standard Typewriter	3
Star Gemini-10X	7
Star Gemini-10X PC Printer	7
Star LaserPrinter 8	10
Star NB-15	3
Star NB24-15	3
Star ND-15	3
Star NL-10 (IBM)	7
Star NX-10	7
Star NX-1000	3
Star NX-1000 Rainbow	7
Star PowerType	9
Star SG-10	7
Talaris 1590-T	4
Talaris T810	4
Talaris T811/3	4
Tandy DMP 130	3
Tandy DMP 430	7
Tandy DMP 440	3
Tandy DMP 2100	7
Tandy DMP 2110	7
Tandy DMP 2120	3
Tandy DWP 220	8
Tandy DWP 230/520	2
Tandy DWP II	8
Tandy DWP IIB	9
Tandy LP 1000	4
TI 850	3
TI 855/857	7
TI OmniLaser 2015	10
TI OmniLaser 2106	2
TI OmniLaser 2115	2
Toshiba P321/P341e/P351/P351C	3
Toshiba P321SL (USA)	8
Toshiba P321SL/P341SL	3
Toshiba P351SX	3
Toshiba P1340	7
Toshiba P1350/P1351	7
Toshiba P1351	8
Toshiba PageLaser12	4
Xerox 4045 / 2700 II	4

Documents at UTCS

All vendor-produced documentation may be ordered through the UTCS Information Office, Room 201, 4 Bancroft Avenue. UTCS documents and selected vendor documents are also stocked there for purchase. For more information on prices, call Dale Wright at 978-4990. Whenever feasible, documents are made available online, and users are encouraged to print their own copies. On the VM machine, a special command has been provided for this purpose.

To print online documents on:

IBM VM/CMS	***GP UNIX***
Type "help document"	Use *ipr* command

The following examples relate to the table below. The document to be printed is the UTCS Guide to Census Tapes, called CENSUS LISTING on CMS and /usr/doc/utcs/census on GP UNIX. <RETURN> means RETURN or ENTER key.

CMS:

```
document <RETURN> <RETURN>
laser census listing (forms yxle <RETURN>
```

GP UNIX:

```
nohup ipr -8p -fyxle /usr/doc/utcs/census & <RETURN>
```

UTCS Documents in hardcopy

New:

Previously announced:

Academic's Guide to Microcomputer Systems
Character Sets for Highspeed Printing
UTCS GUIDE TO PRODUCTS AND SERVICES: Introduction
UTCS GUIDE TO PRODUCTS AND SERVICES: Basics
UTCS GUIDE TO PRODUCTS AND SERVICES: Accounting
UTCS Catalogue: Numerical Products
UTCS Catalogue: Statistics Products
UTCS Catalogue: Text Products
UTCS Guide to Census Tapes
UTCS Guide to Kermit
UTCS Guide to Micro File Transfer Service
UTCS Guide to Text Processing on GP UNIX

UTCS Documents online

	CMS LISTING	GP UNIX	Forms Code
New:			
Previously announced:			
UTCS GUIDE TO PRODUCTS AND SERVICES: Introduction	INTRO	/usr/doc/utcs/intro	*
UTCS GUIDE TO PRODUCTS AND SERVICES: Basics	BASICS	/usr/doc/utcs/basics	*
UTCS Catalogue: Access, Part 1	ACCESS1	/usr/doc/utcs/access1	*
UTCS Catalogue: Access, Part 2		/usr/doc/utcs/access2	*
UTCS Catalogue: Numerical Products	NUMCAT		*
Product-Function List	NUMLIST		BXQD
UTCS Catalogue: Statistics Products	STATCAT		*
Product-Function List	STATLIST		BXQD
UTCS Catalogue: Text Products	TEXTCAT	/usr/doc/utcs/textcat	*
UTCS Guide to BMDP	BMDP		*
UTCS Guide to Census Tapes	CENSUS	/usr/doc/utcs/census	*
Recipes for Using Tapes on VM/CMS	QUIKTAPE		*
UTCS Guide to FORTRAN on VM/CMS	FORTRAN		*
UTCS Guide to GP UNIX		/usr/doc/utcs/gpunix	*
UTCS Guide to Highspeed Printing	PRINT	/usr/doc/utcs/print	*

* *Recommended forms code for the 8700 is YXLE unless otherwise stated.*
† *Use the 87set command. Type "help 87set".*

Documents continued

UTCS Documents online continued

	CMS LISTING	GP UNIX	Forms Code
UTCS Guide to Kermit	KERMIT	/usr/doc/utcs/kermit	*
UTCS Guide to Micro Laser Printing Service	MICRLASR		*
UTCS Guide to SAS	SAS		*
UTCS Guide to SCRIBE	SCRIBE		*
(For printing instructions, see page 1 of document)			
UTCS Guide to Series/1 Terminal Use	SERIES		*
3270 Emulation:			
Cybernex APL100 and Volker Craig VC404	CYBER		*
DM1520	DM1520		*
Hardcopy Terminal	HARDCOPY		*
IBM 3101	IBM3101		*
IBM PC Kermit	PCKERMIT		*
SOROC IQ	SOROC		*
VT52	VT52		*
VT100	VT100		*
UTCS Guide to SPSS	SPSS		*
UTCS Guide to Text Processing on GP UNIX		/usr/doc/utcs/text	YXOG
UTCS Guide to TFW.MAK in SCRIBE	TFWMAK		*
UTCS Guide to VM/CMS	CMSGD		*
UTCS Guide to WSCRIPT	WSCRIPT		*
UTCS Rate Schedule (Commercial)	RATESCOM		†
UTCS Rate Schedule (External)	RATESEXT		†
UTCS Rate Schedule (Internal)	RATESINT		†

Other Documentation online

Electronic Mail			
A User's Guide to Electronic MAIL	MAILBOOK		YXOC
Kermit			
Kermit Protocol Manual	KERMITPM		YXOE
Kermit User Guide	KERMITUG		YXOF
ProComm			
ProComm Reference Manual	PROCOMM		YXOE
VMBATCH Documents			
VMBATCH User's Guide	VMBATCH		YXOA
VMBATCH Messages and Codes	VMBATMC		YXOA
VMSECURE			
VMSECURE User's Guide	VMSECURE		YXOE
VM Tape Documents			
TapeMap User's Guide and Reference	TAPEMAP		*
VMTAPE Messages and Codes	VMTMSGS		YXOE
VMTAPE User's Guide	VMTUSER		YXOE
Waterloo SCRIPT			
Reference Manual	WSCRPTRF		YXLC
User's Guide	WSCRPTUG		YXLC
Using SCRIPT in MVS/TSO	WSCRPTSO		YXLC
Waterloo SCRIPT and a PostScript Printer	WSCRPTPS		YXLC
Formula Processor Summary	WSCRPTFP		YXLC
GML User's Guide	GMLUG		YXLC
GML Reference Summary	GMLRFSUM		YXLC

* *Recommended forms code for the 8700 is YXLE unless otherwise stated.*
† *Use the 87set command. Type "help 87set".*

Consulting and Enquiries

Applications Support & Advising Supervisor	Alex Nishri	BC214	978-7109
External Marketing Consultant	Ihor Prociuk	BC217	978-6875
Erindale College	Joe Lim	ER2035	828-5311
Information Office	Dale Wright	BC201	978-4990
Account & Access Code Enquiries)	Sylvia May	BC101B	978-7148
IBM PC Maintenance	Kam Mark	BC103	978-5050
Tape Library (Academic Services)	Susan Kovago	MP368	978-7319
Tape Library (Administrative Services)	Miranda Fong	MP368	978-6693
Terminal Service	Rosi Tseu	BC105	978-7087
UTCS Noncredit Short Courses	Irene Rosiecki	BC217	978-4565

Consulting & Advising Services:	978-HELP
CMS, and GP UNIX userids:	ADVISOR
CMS Userid for mail problems:	POSTMSTR
System Status Enquiries (GP UNIX)	978-4318
System Status Enquiries (IBM)	978-7393
Interactive Services 300 (bps)	978-6200
Interactive Services 1200 (bps)	978-3959
Interactive Services 2400 (bps)	978-7239

UTCS Directory

Director:	Dr. Warren Jackson	BC118	978-8948	wcj@vm.utcs.utoronto.ca
Associate Director:	Eugene Siciunas	BC116	978-5058	eugene@vm.utcs.utoronto.ca
Managers:				
Communications &Technical Support	Norman Housley	BC121B	978-4967	norman@vm.utcs.utoronto.ca
Information Centre	Don Gibson	BC217	978-7331	don@vm.utcs.utoronto.ca
Internal Systems Support	Ron Vander Kraats	BC121A	978-4428	rvk@vm.utcs.utoronto.ca
Operations Support	Dr. Bob Chambers	MP350	978-7092	
Systems Support	Bill Lauriston	MP331	978-3579	bill@vm.utcs.utoronto.ca

Committees on Computing

Committee on Administrative Computing	Chair	Janice Oliver	978-4322
UTCS Board	Chair	Prof J.F. Keffer	978-4984
Supercomputer Users' Group at U of T	Chair	Prof. J.M. Ting	978-4971
Research Board Standing Committee on Computing	Chair	Prof. C.C. Gotlieb	978-2986

Legend

BC = Bancroft Building
ER = Erindale
MP = McLennan Physical Labs

*** NetNorth/BITNET/EARN**

UTCS Terminal and Advising Sites

Names and Locations

Central Advising Office (CAO), 978-HELP
Engineering Annex (EA, CDF), 11 King's College Road, Rooms 103, 107, 107B, 201, 203
Erindale College (Erin), 828-5339, Mississauga Road, Erindale Campus, Rooms 2037, 2039A-B-C, 2045
Robarts, Robarts Library, 130 St. George St., Room 1061A
Sidney Smith (Sidney), 100 St. George St., Rooms 1071, 2105
St.Michael's College, 121 St. Joseph St., Room 107
Trinity College, 6 Hoskins Ave., Room 024
Victoria University, 73 Queens Park Cres., Room 208

Access Hours

Sites	Hours of Access				Restrictions*	Advising
	Mon-Thurs	Fri	Sat	Sun		
CAO	10:00-18:00	10:00-18:00	closed	closed	Research	978-HELP
CDF	24 hrs	24 hrs	24 hrs	24 hrs	Undergrads	No
EA	24 hrs	24 hrs	24 hrs	24 hrs	None	978-HELP for Research
Erin (2039)Δ	9:00-17:00	9:00-17:00	12:00-16:00	12:00-16:00	Research	Rm 2005
(2045-46-47)	24 hrs	24 hrs	24 hrs	24 hrs	Undergrads	Rm 2005
(235)†	8:00-22:00	8:00-17:00	closed	closed	None	Rm 2046
Robarts	8:30-24:00	8:30-24:00	9:00-22:00	13:00-22:00	None	978-HELP for Research
Sidney	7:00-24:00	7:00-24:00	7:00-24:00	7:00-24:00	None	978-HELP for Research
St.Michael's	24 hrs	24 hrs	24 hrs	24 hrs	None	978-HELP for Research
Trinity	8:00-22:00	8:00-22:00	8:00-22:00	8:00-22:00	None	978-HELP for Research
Victoria	8:30-21:00	8:30-21:00	8:00-13:00	8:00-13:00	None	978-HELP for Research

Sites	Advising Hours
CAO	Monday through Friday, 10:00 - 18:00
Erin	Monday through Friday, 09:00 - 22:00

Legend

* Research includes graduates, faculty, staff.
Δ Key access available.
† Access restricted to building hours.

Terminal and Printer Access

Sites	PACX	Network Terminal Server	Printers	CDF/PC Terminals
CDF	N	N	Y	N
EA	N	Y	Y	N
Erin	Y	Y	Y	N
Robarts	Y	N	Y	Y
Sidney	N	Y	Y	Y
St.Michael's	Y	N	Y	Y
Trinity	Y	N	Y*	Y
Victoria	Y	N	Y*	Y

(Y=yes, N=no)
* CDF/PC only

UTCS Services

UTCS Centrally Owned and Managed

Systems

IBM VM/CMS

- General Purpose Timesharing; access to NetNorth, BITNET, and EARN networks; access to CRAY X-MP/22
- 4381 P02 processor, 16 megabytes of memory
- CP operating system, VM/SP HPO R4.2
- CMS timesharing system, VM/SP Release 4
- RSCS spooling system, Release 3
- CRAY station Release 4

GP UNIX
Technical Assistance: 978-8853

- General Purpose Timesharing under SUN UNIX 3.2
- SUN 3/280, 8 megabytes of memory
- access to Linotronic typesetter
- offers a sophisticated and powerful environment for text processing
- offers a sophisticated programming environment suitable for commercial software development or testing
- full access to USENET, an electronic technical information exchange facility
- offers excellent electronic mail facilities and ability to send or receive mail from most computer networks worldwide, such as UUCPNET, ARPANET, NetNorth, BITNET, CSNET, CDNNET

Services

Communications & Technical Support
Primary Phones: 978-3787, 978-4967

- Communications Group provides communications systems, terminals, modems, data channels: consulting and installation.
- Field Service Group installs and maintains communications and computer systems, particularly IBM PCs, Micro Vaxes, and Macintoshes, on a contract basis or on a cost-per-call basis.
- provides consulting on computer systems technology and installs computer systems
- provides access between the IBM systems and machines using UNIX, VMS and other operating systems. Ethernet, Pronet, and IBM TRN technologies are used over various transmission media including optical fibre. More basic communications techniques are also used for moderate speed links.
- provides consulting on local area networking and installs LANS
- provides access to NetNorth (BITNET), the North American Universities Network; ONET, the Ontario Regional Network; and USENET, the UNIX networking fraternity
- provides gateway to the US Internet
- will provide a communications solution to department needs on a contractual basis

Information Centre
Primary Phone: 978-HELP

- Provides assistance in use of electronic messaging, including use of Local Area Networks (LANS); NetNorth/BITNET/EARN, the world Universities network; CDNNET, the Canadian X.400 network; ARPANET; CSNET; USENET; and other international connections.
- provides advising, consulting and documentation on:
    - command languages, including CMS and UNIX
    - high level languages, including FORTRAN, and PL/I
    - packages and libraries, including SAS, SPSS-X, BMDP, IMSL, and NAg
    - editors and formatters, including XEDIT, ed, nroff/troff
- provides general micro support
    - selection consulting for hardware and software
    - Micro Lab for evaluation of hardware and software
    - advice on University discounts
    - media conversion and data transfer
    - operates UTCS Microcomputer Bulletin Board System
    - offers Micro Laser Printing Service
    - offers 35mm slide production service using Polaroid Palette
    - administers Local Area Network of PCs for Education Facility
    - administers Macintosh Education Facility
- high quality typesetting
- installs and maintains application packages
- provides short courses and seminars on the more popular services and software packages

> *The principal mandate of UTCS is to plan, implement, and operate facilities and "common-carrier" networks, and to plan and support divisional, departmental or project computer facilities as requested.*

Facilities Managed by UTCS

Administrative Computing

- administrative IMS/VS, DB/DC, DB2, Batch, and TS0
- 4381-R14 processor, 32 megabytes of memory
- MVS operating system

Computer Disciplines Facility/UNIX

SUN 3/280s, 8 megabytes of memory (zero.cdf)
- Computer Science interactive access
- SUN UNIX 3.5

SUN 3/280s, 16 megabytes of memory (one.cdf)
- Computer Science interactive access
- SUN UNIX 3.5

Computer Disciplines Facility/PC

- 97 TI Professional Computers connected in a Local Area Network
- introductory Computer Science instruction
- MS-DOS with Turing environment

Erindale College Systems

VAX 8200, 8 megabytes of memory
- instructional access using VMS
- research access

VAX-11/750, 5 megabytes of memory
- instructional access using UNIX (Berkeley UNIX 4.3BSD)

Institutional Relations System

VAX-11/750, 8 megabytes of memory
- database services to the owner departments using VMS

EPAS Facility

- 4361-5 processor, 16 megabytes of memory
- general VM/CMS services to the owner departments

Ontario Centre for Large Scale Computation (OCLSC)

- Cray Research Inc. X-MP/24
- 2 processors, 4 megawords main memory
- solid state disk (SSD) with 64 megawords of storage
- COS 1.17 operating system
- VAX 8350 + MicroVAX II and VAX750 provide VMS front-end services

Software List

SOFTWARE LIST for MICROCOMPUTERS

The following are microcomputer software packages for which UTCS can provide either support or some information. As with mainframe products, micro packages receive full support (Class A), limited support (Class B), or no active support (Class C). The specific criteria differ from those for mainframe classes and are outlined in the Academic's Guide to Microcomputer Systems.

Package/Compiler	Version	Environment	Support
Application Development Tools			
BASIC			
GW BASIC	—	MS-DOS	B
C			
Microsoft C	5.1	MS-DOS	B
MPW C	2.0.2	Macintosh	B
WATCOM C & Express C	6.0	MS-DOS	B
FORTRAN			
IBM FORTRAN/2	1.0	MS-DOS 3.3 & OS/2	B
Language Systems FORTRAN	1.0	Macintosh	C
Microsoft FORTRAN	4.0	MS-DOS	B
WATCOM WATFOR-77	3.0	MS-DOS	A
Pascal			
MPW Pascal	2.0.2	Macintosh	C
TURBO Pascal	—	MS-DOS	B
Tools			
ResEdit	1.2d0	Macintosh	B
HyperCard	1.2.1	Macintosh	A
Macintosh Programmer's Workshop	2.0.2	Macintosh	B
WATCOM GKS	1.3	MS-DOS	B
Communications			
File Transfer & Terminal Emulators			
Kermit	0.8(35)	Macintosh	A
Kermit	2.30	MS-DOS	A
Kermit	—	Apple II DOS	C
Kermit	—	CP/M	C
Lap-Link DeskLink	1.0	MS-DOS	B
Lap-Link Mac	1.2	Macintosh	B
Lap-Link PC	2.16	MS-DOS	B
MacTerminal	2.2	Macintosh	B
PC TALK3	—	MS-DOS	C
PC PLOT III	—	MS-DOS	C
ProComm	TU 2.4.2	MS-DOS	A
Red Ryder	10.3	Macintosh	B
Network Systems			
AppleShare	2.0.1	Macintosh	B
Novell Advanced Netware	2.0a	MS-DOS	B
STARLAN	—	MS-DOS	B
TOPS	2.0	Macintosh	B
TOPS	2.0	MS-DOS	B
Network System Utilities			
Inter•Poll	1.0	Macintosh	C
Database Managers			
4th Dimension	Int. 1.03	Macintosh	B
AskSam	3.0	MS-DOS	B
Clipper	S87	MS-DOS	B
DATAEASE	2.5	MS-DOS	B
dBASE II	—	CP/M	B
dBASE III Plus	1.1	MS-DOS	A
FoxBASE	2.14u	MS-DOS	C
Notebook II	2.03	MS-DOS	C
REFLEX	—	MS-DOS	B
ZyINDEX	—	MS-DOS	B
Desktop Publishing			
PageMaker	3.01	Macintosh	A
PageMaker	3.0	MS-DOS	A

Software List continued

Package/Compiler	Version	Environment	Support
Ready Set Go	4.0	Macintosh	C
Ventura	2.0	MS-DOS	B
XPress	1.0	Macintosh	C
Electronic Mail			
Microsoft Mail	1.36	Macintosh	B
QuickMail	1.0	Macintosh	B
Graphics			
Charting			
35mm Express	4.02	MS-DOS	B
Cricket Graph	1.2	Macintosh	C
Freelance Plus	2.01	MS-DOS	B
Harvard Graphics	2.1	MS-DOS	B
Lotus 1-2-3	2.01a	MS-DOS	B
Microsoft Excel	1.5	Macintosh	B
Microsoft Excel	2.0	MS-DOS	B
SigmaPlot	—	MS-DOS	C
Draw and CAD			
Aldus Freehand	1.0	Macintosh	B
Cricket Draw	1.1	Macintosh	C
Generic CADD	3.0	MS-DOS	C
MiniCad	4.05	Macintosh	C
Illustrator	1.0	Macintosh	B
Illustrator88	1.6	Macintosh	B
MacDraft	1.2b	Macintosh	C
MacDraw	1.95	Macintosh	A
MacDraw II	1.0v1	Macintosh	B
Windows Draw	1.02	MS-DOS	C
Image and Scanning			
ImageStudio	1.05	Macintosh	B
Publish Pac	2.0	Macintosh	B
Publish Pac	2.1	MS-DOS	B
Text Pac	2.0	MS-DOS	B
Paint			
DR HALO	1.23	MS-DOS	C
MacPaint	2.0	Macintosh	A
Microsoft Paintbrush	2.0	MS-DOS	C
PC Paintbrush	2.5	MS-DOS	C
SuperPaint	1.1	Macintosh	B
Windows Paint	2.03	MS-DOS	C
Plotting Subroutines			
WATCOM GKS	1.3	MS-DOS	B
Numerical			
Derive	1.14	MS-DOS	C
Eispack	n/a	MS-DOS	C
Eureka	n/a	MS-DOS	C
GAUSS	2.0	MS-DOS	B
IMSL	10.0	MS-DOS	A
Linpack	n/a	MS-DOS	C
MathCAD	2.0	MS-DOS	C
muMATH-83	4.12	MS-DOS	C
Operating Systems			
IBM PC, PS/2, and compatibles			
IBM OS/2	1.0	n/a	B
IBM PC-DOS	3.3	n/a	B
Microsoft MS-DOS (incl IBM PC-DOS)	3.2	n/a	A

Software List continued

Package/Compiler	Version	Environment	Support
Microsoft Windows	2.03	n/a	A
Microsoft Windows 386	2.03	n/a	C
Macintosh II, Macintosh SE, and Macintosh Plus			
Finder	6.1	n/a	A
MultiFinder	6.0.1	n/a	A
System	6.0.2	n/a	A
Apple II			
Apple II DOS	3.3	n/a	C
CP/M	2.20	n/a	C
ProDos	1.0	n/a	C
Sound			
SoundWave	1.0	Macintosh	B
MacRecorder	1.0	Macintosh	B
Spreadsheet			
APPLEWORKS	—	MS-DOS	C
HAL	1.0	MS-DOS	B
Lotus 1-2-3	2.01a	MS-DOS	B
Microsoft Excel	1.5	Macintosh	B
Microsoft Excel	2.0	MS-DOS	B
Multiplan	1.5	Macintosh	C
Statistical			
MACSPIN	1.5	Macintosh	C
Minitab	82.1.1	MS-DOS	C
PowerStat	1.04	MS-DOS	C
SAS/PC	6.03	MS-DOS	A
SPSS/PC+	2.0	MS-DOS	A
STATPRO	2.0c	MS-DOS	C
STATWORKS	1.2	Macintosh	B
SYSTAT	3.2	Macintosh	B
SYSTAT	3.2	MS-DOS	B
Word Processing			
Guide	2.0	MS-DOS	C
FinalWord II	2.0	MS-DOS	C
MacWrite	5.01	Macintosh	B
Manuscript	1.0	MS-DOS	C
Microsoft Word	3.01	Macintosh	A
Microsoft Word	4.0	MS-DOS	A
Nota Bene	3.0	MS-DOS	B
Nota Bene SLS	3.0	MS-DOS	B
PC-TeX	2.1	MS-DOS	B
Sprint	1.0	MS-DOS	B
T^3	—	MS-DOS	C
Volkswriter Scientific	—	MS-DOS	C
WordPerfect	4.2 & 5.0	MS-DOS	A
WordPerfect	1.0	Macintosh	C
WordPerfect Library	2.0	MS-DOS	C
WordStar	3.3	MS-DOS	B
Utilities			
Apple Turnover	—	MS-DOS	A
FASTBACK	—	MS-DOS	B
Norton Utilities	4.0	MS-DOS	A
Copy II Disk	7.1	Macintosh	B
Mace Utilities	—	MS-DOS	B
MacZap	5.1	Macintosh	B
Sidekick	—	MS-DOS	B
SuperKey	—	MS-DOS	C
TURBO Lightning	—	MS-DOS	C
XenoDisk	1.41	MS-DOS	A

Software List continued

SOFTWARE LIST for MAINFRAME COMPUTERS VM/CMS, UNIX

Each programming language or package available at UTCS has a support level. In general, Class A Products receive full support, Class B limited support (as time and resources allow), Class C no active support.

For complete details of UTCS product support policy, see the UTCS GUIDE TO PRODUCTS AND SERVICES: Introduction.

Package/Compiler	System	Support	Version
Communications			
Kermit	VM/CMS	A	---
Kermit	UNIX	B	4C(058)
FTS	VM/CMS	A	---
MAIL/MAILBOOK	VM/CMS	A	86.359
MICROLASER	VM/CMS	A	---
macget/macput	UNIX	C	---
netcopy, netexec, to (NetNorth Tools)	UNIX	B	---
xmodem	UNIX	C	---
ftp,rsh,rlogin,telnet,rcp (Access via TCP/IP to most of the networked machines on all three campuses)	UNIX	B	---
rn/Pnews	UNIX	B	---
mail,mh,Mail	UNIX	-	---
Graphics			
PLOTBASIC (FORTRAN)	VM/CMS	C	---
SAS/GRAPH	VM/CMS	A	5.16, 5.18
Languages			
ASSEMBLER(F)	VM/CMS	C	---
Concurrent Euclid	VM/CMS	C	1.9
FORTUTILS	VM/CMS	A	2.2
PL/I OPT Compiler	VM/CMS	B	1.5.1
REXX	VM/CMS	A	---
SNOBOL 4	VM/CMS	C	3.5
Turing	VM/CMS	C	---
VS FORTRAN	VM/CMS	A	1.4.1
VS Pascal	VM/CMS	C	2.2
Waterloo C	VM/CMS	C	1.3
WATFIV	VM/CMS	C	V2L0
WATFOR-77	VM/CMS	A	1.3
cc	UNIX	A	---
f77	UNIX	C	---
ratfor	UNIX	C	BSD std.
ttc	UNIX	C	---
pc	UNIX	C	BSD std.
yacc	UNIX	C	---
awk	UNIX	C	---
adb,dbx	UNIX	C	BSD std.
Numerical			
IMSL	VM/CMS	A	9.2,10.0
LINPACK	VM/CMS	C	---
NAg	VM/CMS	A	Mark 11
Statistical			
BMDP	VM/CMS	A	Level 85, Level 87
Minitab	VM/CMS	B	5.1
NAg	VM/CMS	A	Mark 11
NTSYS	VM/CMS	C	1987
SAS	VM/CMS	A	5.18
SPSS^x	VM/CMS	A	2.2

Software List continued

Package/Compiler	System	Support	Version
Text Processing			
SCRIBE	VM/CMS	C	4(1400)-1
Waterloo SCRIPT	VM/CMS	B	86.1
XEDIT	VM/CMS	A	---
8700 Pseudotypesetting	VM/CMS	C	n/a
MICROLASER	VM/CMS	A	---
ed	UNIX	A	---
vi	UNIX	C	---
cmacs	UNIX	C	---
spell	UNIX	C	---
diction/explain	UNIX	C	---
eqn	UNIX	B	---
tbl	UNIX	B	---
pic	UNIX	C	---
troff	UNIX	B	---
nroff	UNIX	B	---
TeX	UNIX	C	---
Utilities			
FORTUTILS	VM/CMS	A	2.2
TPRINT	VM/CMS	C	---
crypt	UNIX	A	BSD std.
compress	UNIX	C	BSD std.
csh	UNIX	B	BSD std.
diff	UNIX	A	BSD std.
grep	UNIX	A	BSD std.
ipr	UNIX	B	---
learn	UNIX	C	BSD std.
patch	UNIX	C	---
sed	UNIX	A	BSD std.
sort	UNIX	A	BSD std.
sh	UNIX	A	BSD std.
tar	UNIX	A	BSD std.
uniq	UNIX	A	BSD std.

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